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ABSTRACT

This ninth in a series of nine learning modules on instructional management is designed to give secondary and postsecondary vocational teachers skill in managing and maintaining a laboratory in an ongoing program. Introductory sections relate the competency dealt with in this module to others in the program and list both the enabling objectives for the six learning experiences and the resources required. Materials in the learning experiences include required reading, a student progress chart, a self-check quiz, a critique, model answers, inventory and maintenance record forms, a maintenance systems checklist, an assignment wheel, a student personnel system checklist, a laboratory observation checklist, a laboratory management planning checklist, and the teacher performance assessment form for use in evaluation of the terminal objective. (The modules on instructional management are part of a larger series of 100 performance-based teacher education (PBTE) self-contained learning packages for use in preservice or inservice training of teachers in all occupational areas. Each of the field-tested modules focuses on the development of one or more specific professional competencies identified through research as important to vocational teachers. Materials are designed for use by teachers, either on an individual or group basis, working under the direction of one or more resource persons/instructors.) (BL)

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ED149108

MODULE

E-9

Manage the Vocational Laboratory

MODULE E-9 OF CATEGORY E—INSTRUCTIONAL MANAGEMENT
PROFESSIONAL TEACHER EDUCATION MODULE SERIES

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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CE 014 344

FOREWORD

This module is one of a series of 100 performance-based teacher education (PBTE) learning packages focusing upon specific professional competencies of vocational teachers. The competencies upon which these modules are based were identified and verified through research as being important to successful vocational teaching at both the secondary and post-secondary levels of instruction. The modules are suitable for the preparation of teachers in all occupational areas.

Each module provides learning experiences that integrate theory and application; each culminates with criterion referenced assessment of the teacher's performance of the specified competency. The materials are designed for use by individual or groups of teachers in training working under the direction and with the assistance of teacher educators acting as resource persons. Resource persons should be skilled in the teacher competency being developed and should be thoroughly oriented to PBTE concepts and procedures in using these materials.

The design of the materials provides considerable flexibility for planning and conducting performance-based preservice and inservice teacher preparation programs to meet a wide variety of individual needs and interests. The materials are intended for use by universities and colleges, state departments of education, post-secondary institutions, local education agencies, and others responsible for the professional development of vocational teachers. Further information about the use of the modules in teacher education programs is contained in three related documents: **Student Guide to Using Performance-Based Teacher Education Materials, Resource Person Guide to Using Performance-Based Teacher Education Materials** and **Guide to Implementation of Performance-Based Teacher Education.**

The PBTE curriculum packages are products of a sustained research and development effort by The Center's Program for Professional Development for Vocational Education. Many individuals, institutions, and agencies participated with The Center and have made contributions to the systematic development, testing, revision, and refinement of these very significant training materials. Over 40 teacher educators provided input in development of initial versions of the modules; over 2,000 teachers and 300 resource persons in 20 universities, colleges, and post-secondary institutions used the materials and provided feedback to The Center for revision and refinement.

Special recognition for major individual roles in the direction, development, coordination of testing, revision, and refinement of these materials is extended to the following program staff: James B. Hamilton, Program Director; Robert E. Norton, Associate Program Director; Glen E. Fardig, Specialist; Lois Harrington, Program Assistant; and Karen Quinn, Program Assistant. Recognition is also extended to Kristy Ross, Technical Assistant; Joan Jones, Technical Assistant; and Jean Wisenbaugh, Artist for their contributions to the final refinement of the materials. Contributions made by former program staff toward developmental versions of these materials are also acknowledged. Calvin J. Cotrell directed the vocational teacher competency research studies upon which these modules are based and also directed the curriculum development effort from 1971–1972. Curtis R. Finch provided leadership for the program from 1972–1974.

Appreciation is also extended to all those outside The Center (consultants, field site coordinators, teacher educators, teachers, and others) who contributed so generously in various phases of the total effort. Early versions of the materials were developed by The Center in cooperation with the vocational teacher education faculties at Oregon State University and at the University of Missouri-Columbia. Preliminary testing of the materials was conducted at Oregon State University, Temple University, and University of Missouri-Columbia.

Following preliminary testing, major revision of all materials was performed by Center Staff with the assistance of numerous consultants and visiting scholars from throughout the country.

Advanced testing of the materials was carried out with assistance of the vocational teacher educators and students of Central Washington State College; Colorado State University; Ferris State College, Michigan; Florida State University; Holland College, P.E.I., Canada; Oklahoma State University; Rutgers University; State University College at Buffalo; Temple University; University of Arizona; University of Michigan-Flint; University of Minnesota-Twin Cities; University of Nebraska-Lincoln; University of Northern Colorado; University of Pittsburgh; University of Tennessee; University of Vermont; and Utah State University.

The Center is grateful to the National Institute of Education for sponsorship of this PBTE curriculum development effort from 1972 through its completion. Appreciation is extended to the Bureau of Occupational and Adult Education of the U.S. Office of Education for their sponsorship of training and advanced testing of the materials at 10 sites under provisions of EPDA Part F, Section 553. Recognition of funding support of the advanced testing effort is also extended to Ferris State College, Holland College, Temple University, and the University of Michigan-Flint.

Robert E. Taylor
Executive Director
The Center for Vocational Education

THE CENTER FOR VOCATIONAL EDUCATION
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The Center for Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The Center fulfills its mission by:

- Generating knowledge through research.
- Developing educational programs and products.
- Evaluating individual program needs and outcomes.
- Installing educational programs and products.
- Operating information systems and services.
- Conducting leadership development and training programs.

AA VIM

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The American Association for Vocational Instructional Materials (AAVIM) is an interstate organization of universities, colleges and divisions of vocational education devoted to the improvement of teaching through better information and teaching aids.

INTRODUCTION

A well-managed vocational laboratory is like a great smooth-running machine. The students work like precision gears; the equipment runs as one intricate and complex mechanism. The teacher functions as the throttle and linkage, moving back and forth to control the energy of the whole operation. Teaching and learning are accompanied in the laboratory by a quiet whirring of activity.

Like a beautifully engineered machine, a good laboratory is a source of satisfaction and pleasure. The teacher works with a minimum of tension and fatigue, and a great sense of accomplishment. Students learn the skills of their chosen occupation rapidly and well, and find joy in learning. School administrators appreciate the efficient way in which the community's resources are being used.

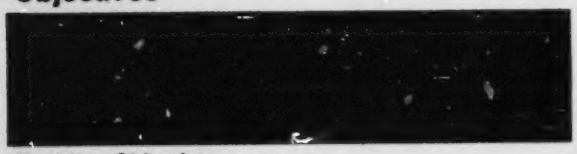
Everybody benefits—but only if **all** contribute. The teacher needs to develop management plans and procedures and see that they are maintained. Students need to participate in the work of keeping the facility orderly and the equipment functioning. The school administration should cooperate with teachers to establish and support workable policies for laboratory use.

Each vocational education area has laboratories that are unique to itself, yet there are needs, problems, and solutions that all laboratories share. It is to these common areas that this module is addressed. Five of the more important common aspects of managing and maintaining vocational laboratories are (1) controlling the environment in the laboratory, (2) controlling tools and supplies, (3) maintaining equipment, (4) maintaining a student personnel system, and (5) scheduling laboratory use. All these management concerns are interrelated, and all are responsibilities of the vocational teacher.

Module E–8, *Organize the Vocational Laboratory*, is concerned with planning, designing, and organizing the physical facilities of the vocational education laboratory. **This** module is designed to give you skill in managing and maintaining the laboratory in an ongoing program, and solving the day-to-day problems of laboratory management. It will help you develop a laboratory program that will function efficiently and will be a potent factor in helping students achieve their educational goals.

ABOUT THIS MODULE

Objectives



Enabling Objectives:

1. After completing the required reading, demonstrate knowledge of the principles and procedures involved in managing a vocational laboratory (*Learning Experience I*).
2. After completing the required reading, plan an inventory control system for a vocational laboratory in your occupational specialty (*Learning Experience II*).
3. After completing the required reading, plan an equipment maintenance system for a vocational laboratory in your occupational specialty (*Learning Experience III*).
4. After completing the required reading, plan a student personnel system for a vocational laboratory in your occupational specialty (*Learning Experience IV*).
5. Given an actual vocational laboratory in your occupational specialty, evaluate the management system of the laboratory and develop plans for its improvement (*Learning Experience V*).

Resources

A list of the outside resources which supplement those contained within the module follows. Check with your resource person (1) to determine the availability and the location of these resources, (2) to locate additional references in your occupational specialty, and (3) to get assistance in setting up activities with peers or observations of skilled teachers, if necessary. Your resource person may also be contacted if you have any difficulty with directions, or in assessing your progress at any time.

Learning Experience I

Optional

Reference: Silvius, G. Harold and Estell H. Curry. *Managing Multiple Activities in Industrial Education*. Bloomington, IL: McKnight and McKnight Publishing Company, 1971.

Learning Experience II

Optional

Reference: Storm, George. *Managing the Occupational Education Laboratory*. Belmont, CA: Wadsworth Publishing Company, 1976.

A vocational laboratory in your occupational specialty which you can visit.

Learning Experience III

Optional

Reference: Storm, George. *Managing the Occupational Education Laboratory*. Belmont, CA: Wadsworth Publishing Company, 1976.

A vocational laboratory in your occupational specialty which you can visit.

Learning Experience IV

Optional

A vocational laboratory in your occupational specialty which you can visit.

Learning Experience V

Required

A vocational laboratory in your occupational specialty which you can visit and evaluate.

A resource person to assess your competency in evaluating the management of a vocational laboratory and planning for its improvement.

Learning Experience VI

Required

An actual school situation in which you can manage a vocational laboratory.

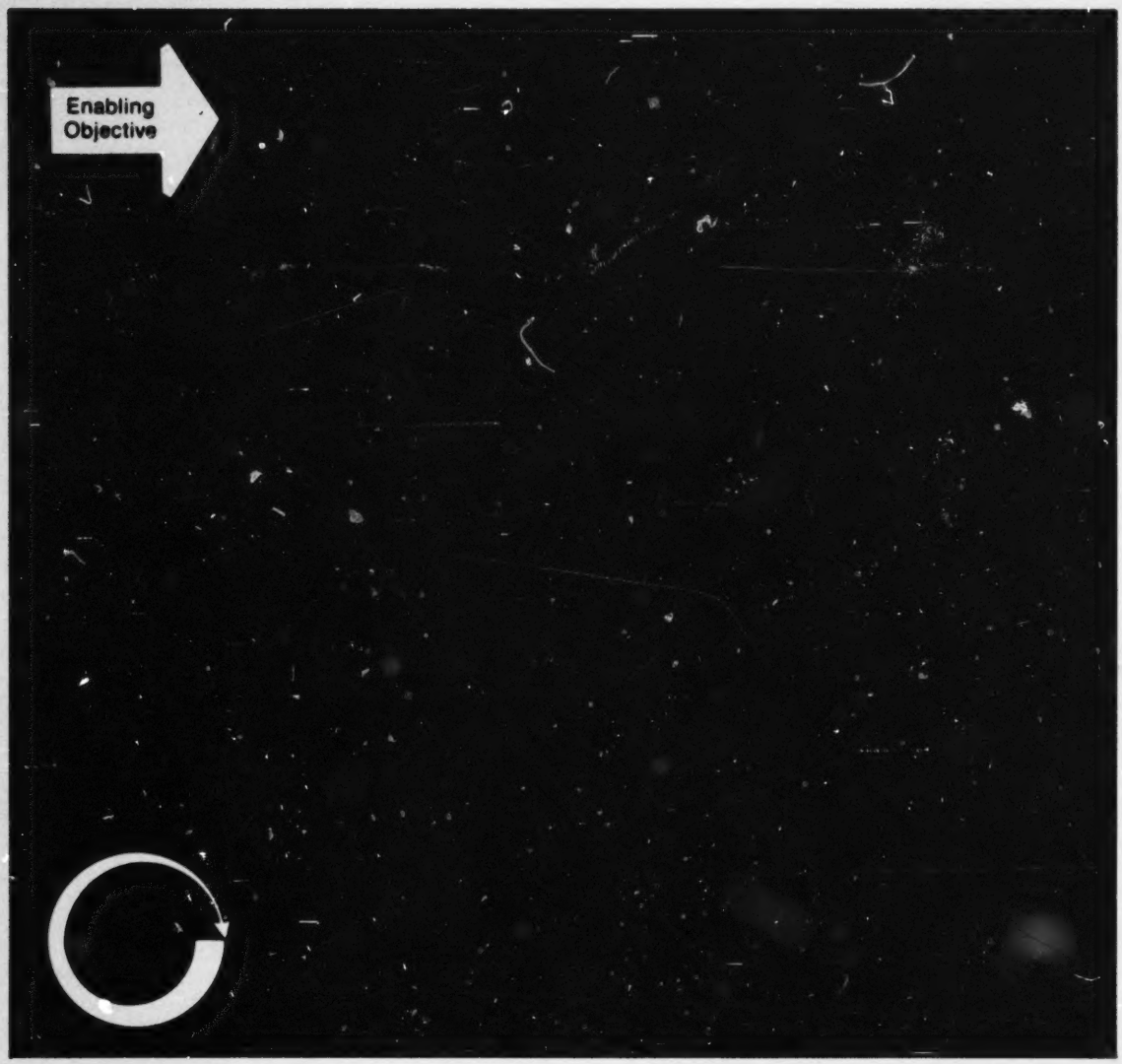
A resource person to assess your competency in managing a vocational laboratory.

This module covers performance element numbers 192, 193, 195–197, 200, 201 from Calvin J. Cotrell *et al., Model Curricula for Vocational and Technical Teacher Education: Report No. V* (Columbus, OH: The Center for Vocational Education, The Ohio State University, 1972). The 384 elements in this document form the research base for all The Center's PBTE module development.

For information about the general organization of each module, general procedures for their use, and terminology which is common to all 100 modules, see About Using The Center's PBTE Modules on the inside back cover.

Learning Experience I

OVERVIEW



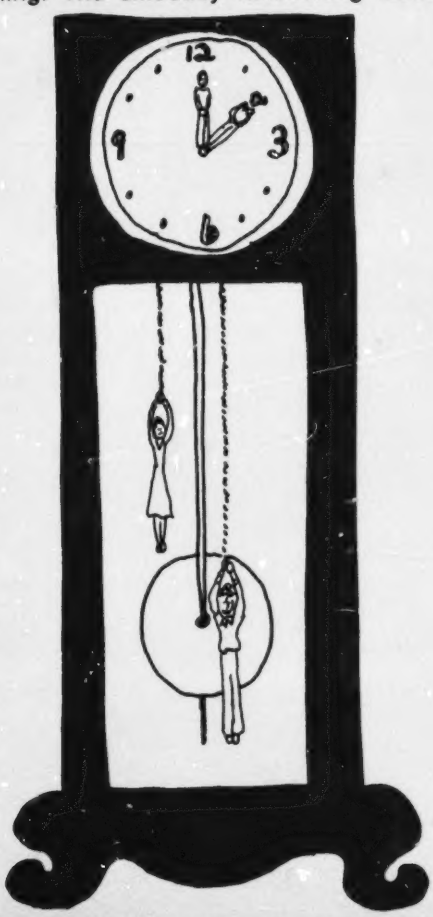
Read the following information sheet about the general principles and procedures involved in managing and maintaining a vocational laboratory. As you read, attempt to relate the information to laboratories in your own occupational area.

MANAGING THE VOCATIONAL LABORATORY

Most vocational education laboratories are complex and expensive facilities. It is important that they be managed well if the community's investment in them is to be properly utilized and the goals of the program are to be achieved. There is equipment to acquire and maintain, supplies to be purchased and distributed, a physical facility to be arranged and kept in order, and students to be organized and given direction.

All this is a demanding part of your duties. At the same time, a well-managed laboratory can be a source of great personal satisfaction to you and a boon to students as they work to learn the skills of their chosen occupation.

Laboratory management is not, of course, an end in itself. A clean and bright laboratory with every tool in place, every instrument and machine gleaming from loving care, and every student moving like clockwork is an impressive sight, but it should not be considered the ultimate goal of teaching. The smoothly functioning laboratory should be designed to allow students to successfully enter their occupation, and should be protected so that it is available to generations of students as they move through the program.



There are quite a number of reasons why good laboratory management is so important. A laboratory in which the tools and equipment are in order, the noise under control, and the students well organized **facilitates instruction.** You can work effectively because the instruments of teaching are available, the students can see and hear instruction, and the atmosphere enhances your effectiveness.

An orderly laboratory **fosters student learning.** The facilities encourage use, the physical environment is comfortable, and the clean and bright surroundings are psychologically stimulating. Students can learn because the requirements for learning and practice are all there. The student identifies with a successful operation in which he or she, too, can succeed.

A well-organized and maintained laboratory **provides a safe setting** in which you and your students can work. Equipment which is in good operating condition, well-adjusted and properly sharpened tools, clean floors and counter tops, good lighting, and neat storage all contribute heavily to safety. Ensuring student safety through good laboratory management is one of your prime responsibilities.

The **community** expects its **investment** in the vocational program to be wisely used and conscientiously protected. Since the cost of education is a major portion of the local tax burden, the community is concerned that expensive equipment is maintained to ensure years of instructional use, and that teachers make every effort to control loss and damage. It is difficult for schools to retain their support unless basic standards of good management are achieved.

By working in a laboratory that is itself a model of excellence, **students can learn acceptable occupational work habits and procedures.** They can begin to acquire an understanding of the responsibilities they will have for maintaining their own work stations, and will learn the expectations of employers in their field. If they participate in a successful laboratory maintenance program, they

will develop positive attitudes toward efficiency, craftsmanship, and the care of tools and equipment. In attractive surroundings, students will tend to enjoy learning, and therefore want to continue to work and learn in their occupation.

A pleasant and businesslike laboratory **will attract new, interested, and capable students.** If they see exciting activities going on in an impressive setting, good students will want to become involved and will be proud to be a part of the program.

The vocational laboratory management system should have clearly thought through objectives. These objectives should be based on, or consistent with, the goals of the total vocational program. While they may not need to be written down, laboratory management objectives should be thoughtfully established. You should ask yourself, "Just what am I trying to accomplish in organizing the laboratory?" and "Why am I doing it this way?" Such self-examination can keep the management program in proper perspective and can help expose management ideas that are simply personal habits or idiosyncrasies.

For example, one typing teacher insisted that students fold wastepaper instead of wadding it before putting it in the wastebasket. An auto mechanics teacher assigned a student to clean the water cooler at the end of each period. A drafting teacher allowed students to operate the blueprint machine only on Fridays. It is questionable whether these management rules are really designed to promote the goals of the program, or are consistent with the demands of the occupation.

Before developing a set of laboratory management plans, it is helpful to review the stated goals and objectives of the program. If statements of goals and objectives do not exist, then it is likely that they should be prepared. Each objective should be examined to see if it has any implications for laboratory management.

For example, assume an objective states that "the student will exhibit the ability to work effectively with others in a small group on a common task." Organizing laboratory cleanup and maintenance around small work crews would be appropriate to meet this objective. If, on reviewing the program objectives, you find nothing about assisting handicapped students to enter and complete the program, then perhaps the objectives should be reexamined.

Controlling the Laboratory Environment

One of your general management duties is to control the laboratory environment. This includes providing proper heating, healthful ventilation, adequate lighting, and controlled noise level. Laboratories that are too hot or cold, poorly ventilated, or noisy cause physical discomfort to students. They increase behavior problems and interfere with learning. To some extent, you can control the laboratory environment and adjust it to suit the situation.

While most lighting fixtures are permanent parts of the building, you can usually control the type and the amount of light. The fixtures, bulbs, and tubes can be regularly inspected to be sure they are operating efficiently. Steps should be taken immediately to have poor or nonfunctioning lighting replaced.

It is usually good practice in modern laboratories to turn on the general lighting when classes begin and leave it on during the school day. Special local lighting in storage areas, exhibit spaces, and on machines should be used when needed. Window shades can be raised or lowered as necessary to provide maximum light without direct glare. An ill-lighted, gloomy laboratory is not only an unsafe and inefficient place to work, it is also depressing to both students and teacher. Sometimes all that is necessary to remedy the situation is a flick of the light switch.

You need to make sure that the laboratory has a supply of fresh air and the room is at the proper temperature. You can turn the ventilating fans on when needed and, perhaps, adjust the window openings. In some buildings, the heating and cool-

ing thermostat can be regulated to control the temperature in the individual laboratory. You can operate the exhaust systems as needed to remove potentially harmful dust, gases, and exhaust emissions.

A good air environment is always desirable, but in some occupational areas, state or local health and safety regulations are also involved. You need to make sure that your laboratory meets these standards.

Some vocational programs require special environmental conditions to be maintained in the laboratory. The horticulture program's greenhouse may require a high relative humidity. A meat-cutting laboratory may need an unusually lower temperature. Teachers of such programs should know what is required and should make sure the custodial staff makes the necessary adjustments to maintain the right conditions.

Noise is a big problem in many schools and laboratories, and it is becoming more and more severe. As schools get more crowded, and as the world outside the schools gets increasingly noisy, the laboratory becomes a more difficult place in which to work. Because the effects of noise can result in apathy, depression, lack of concentration, or fatigue, you must make every effort to keep noise under control.

Noise is unwanted sound. Thus, even the sound of the band playing the school song in the other wing of the building, or the sound track of a next-door teacher's film, is noise in the laboratory.

Noise coming from outside the laboratory can be at least partially controlled. Doors or windows can be closed, or acoustic ceiling tile installed. Sometimes it may be necessary to work out a cooperative arrangement with your fellow teachers so that their class noises are not scheduled during your lecture/demonstration times, and vice versa.

You may also be able to reduce the noise produced within your own laboratory. When purchasing equipment, if a quieter, more well-insulated model is available, specify that model. Sound-absorbing cork pads can be installed under the legs of vibrating machines. Fiberglass padding can be placed inside machine cabinets. You can keep equipment well adjusted and replace worn, noisy parts to hold down sound levels. Power cutting tools (such as circular saws) make less noise if the blades are kept sharp and clean.

Some laboratory noise (like that produced in testing jet aircraft engines) is so intense that it requires sophisticated engineering to keep it within tolerable limits. The individual teacher cannot solve such problems. If all else fails, require that students wear ear protection devices when operating especially noisy machines.

Another source of noise is that produced by the students themselves. While most students cannot be expected to work in silence, they can be expected to keep noise down to a minimum. Equipment noise begets student-created noise, which starts a vicious circle of confusion. If students are to learn, you must control the amount and level of their conversations.

Of course, there are definite limits to what you can do to provide a quality laboratory environment. The laboratory may be directly under the flight pattern of a nearby airport. The school engineer may control the heating, ventilation, and even lighting for the entire building. The vocational laboratory may be located next to the agriculture cow barn, and the roof may leak. You then

must use every device to minimize the difficulties and utilize the advantages of the situation to the fullest extent. However, some things may simply have to be endured because nothing can be done about them.

Tool and Instrument Management

In most vocational education laboratories, there are a great number and variety of tools and instruments which need to be provided to students. Tools are devices or instruments used by the craftsman in the course of work, and are usually portable and hand operated. The mechanic's hammer and wrenches, the machinist's micrometers, the cook's carving knives, the office worker's rubber stamps, and the nurse's stopwatch can all be considered tools.

Tools range in size from tiny burrs used in the dental auxiliary program to giant wrenches used for diesel engines. Some tools are very cheap, but many are extremely expensive. The thing they have

in common is that they are in constant use by students and must be readily available to them. Yet, they must be managed by the teacher to keep the tools in good condition and under control. This is no simple task, and it usually requires some form of highly organized system.

Management of tools and instruments is an important aspect of your responsibilities. While some of the duties of tool management may be delegated to others (e.g., a teacher's aide may do the sharpening or adjustment), the ultimate responsibility must be the teacher's. The community expects you to safeguard its investment in laboratory tools, and to utilize them efficiently.

The whole instructional program is affected by the effectiveness of the tool management system. Students cannot work and learn efficiently if the essential tools are lost or in poor condition. Their interest and enthusiasm soon lag. On the other hand, a smoothly functioning management system promotes habits of orderliness and efficiency in future workers. In planning your tool management system, there are several principles that should be considered.

All the necessary tools and instruments of the occupation should be available to students.—You should not retain a separate collection for your exclusive use. However, very delicate or very expensive tools should usually be kept securely under the teacher's control. Students can then sign the tools out when they are needed.

Tools that are frequently used by students should be located as close as possible to the work area in which they are to be used.—This saves students' time and minimizes the problem of students disturbing each other as they move around the laboratory.

Tools should be organized so they can be quickly and accurately located by students.—In practice, this means that each tool must have a definitely assigned spot and that there should be some logical grouping arrangement (e.g., all measuring tools together, all templates grouped on one panel, etc.).

Tools that come in a series or in gradations of some kind (e.g., size, color), should be organized in sequence for easy identification.—For example, metric wrenches should be placed so that 10, 11, and 12 mm wrenches are next to each other; lettering pens should be arranged from fine to heavy. Of course, this means that tool holders have to be designed so that only the correct tool will fit the holder. If this is not done, the series will be constantly out of sequence because, when several tools are off the panel, it will be difficult to replace any one tool correctly.

Tools should be organized so the teacher can visually inspect them quickly and easily at the beginning and end of the laboratory period.—The teacher should be able to see almost at a glance whether a tool is in its right place and in proper condition.

Tools should be made to look and feel attractive.—A good worker takes pride in fine tools, and this attitude can be learned through the training program. Tool surfaces should be bright and clean, the bodies painted or finished as appropriate, the handles smooth and neat. It is difficult to enjoy working with rusty tools with sticky handles, even if they do actually work satisfactorily.

Tools should be stored in such a way as to prevent damage.—For example, hand saws should be hung separately on a panel, not piled in a drawer where they will damage each other; metal tools should never be stored near hydrochloric acid since the acid fumes will cause severe corrosion.

Lost or damaged tools should be replaced quickly.—Student work should not be hampered by the lack of a single tool. If tools are not replaced, you may have difficulty remembering which ones are supposed to be there and which are not. The tool management system soon gets out of control. If it is impossible to replace the item immediately, its place on the storage panel should be taken by a tag or other marker saying, "Being Repaired" or "To Be Replaced."

There are several suitable techniques for providing students with access to tools. The choice for any particular vocational program will depend on a number of local factors including (1) how tools are traditionally handled in the occupation, (2) how many related programs there are in the occupational cluster, (3) the number and complexity of tools needed in the training program, and (4) the degree of security required to safeguard tools in a particular school setting.

Following are a number of techniques for making tools accessible to students. Combinations of these various tool distribution techniques may be the best solution.

Tool storage rooms (tool cribs) may be located within the laboratory.—Students may check out tools from the attendant (a fellow student assigned on a rotating basis). This method increases security, but usually creates considerable waste of time.

A centrally located tool room may serve several vocational education laboratories.—If the number of programs warrants it, a paid attendant may be in charge. There is a possibility with this arrangement that students will lose still more time.

Open tool panels located conveniently about the laboratory give students free access to tools.—They may be closed and locked when the class is not in session. If properly designed, such panels can be attractive, convenient, and safe. They will, however, need to be inspected on a regular basis by the teacher.

Kits of basic tools can be assigned to each student for a designated period of time.—Students work more effectively because the needed tool is always handy. The expense of providing multiple sets of tools may be high, however, and storage space may need to be provided for the tool kits.

Students may be required to purchase their own set of basic tools.—This method is defensible if they will be expected to have their own tools when they enter the occupation as beginning workers. If draftsmen are expected to have their own set of drafting instuments, they may as well acquire and learn to use them in the training program. Teachers of some trades (e.g., machinist, tool and die maker) often encourage students to gradually acquire a set of precision tools for themselves.

"A place for everything, and everything in its place," is an adage that is particularly appropriate for a vocational education laboratory. An organized tool management system that provides a convenient and safe place for everything will be of tremendous value to the program. Students and teacher alike will enjoy productive work in the laboratory.

Handling Supplies

If students are to learn through laboratory practice, the necessary supplies for the learning activities must be available to them. You have the job of getting the supplies, storing them properly, and distributing them to students when they are needed. These can become time-consuming tasks which take away from the central work of instruction. Therefore, you should manage the supply system so it functions with as little effort as possible and, yet, controls supplies efficiently. Many supply items are expensive; others pose handling problems because they must be stocked in great variety, or are bulky or hazardous. Without an efficient system, you will spend a great deal of time and effort trying to solve supply problems and taking care of emergency needs.

Laboratory supplies are unique to each occupational area, but there are some characteristics or qualities of laboratory systems that are common to all. Most important of these are the following. First, students should have **all the supplies** that are necessary to complete the learning activities they are doing to attain occupational competencies. These supplies should be of **appropriate type and quality** for the learning activities, and should be in good condition when they reach the student. Poor materials discourage good work.

Supplies should be **readily available** to students so they do not waste valuable laboratory time waiting for supplies. This does not mean that you should be constantly running to provide students with materials. The system should help students to work efficiently, not be an obstacle to them.

Waste of laboratory supplies must be **kept to an absolute minimum.** This requires well-managed supply storage, intelligent purchasing, and organized distribution. Students often need to be taught how to avoid waste. They may not realize, for example, that cutting a section out of the middle of a board or a piece of fabric, just because that piece is most attractive, is poor practice. In some occupations, knowing how to use supplies without waste is an important occupational competence.

Loss of supplies due to carelessness, pilferage, or vandalism must be **kept in check.** This is an increasingly difficult problem for vocational teachers and will require considerable effort in some settings.

Hazardous substances, or materials subject to student abuse, must not only be **stored securely,** but must be distributed so as to **control** their use.

Some of the above characteristics of a good supply system are apparently contradictory. For example, students should have ready access to needed supplies, yet loss of supplies must be controlled. If possible, you will want to devise supply procedures so that all desirable characteristics are included. It may be necessary, however, to make some compromises. In that case, it will be necessary to decide which are the most important objectives of the supply system. Is it better, for example, to be sure that students can get supplies easily and quickly, even if this means some chance of loss?

Dispensing Supplies

Vocational teachers do not always agree on the best system for dispensing supplies from storage to students. They do tend to agree that if it is not done systematically, it will be a nuisance to the teacher and will distract from the work of instruction. As in handling tools, the choice of the system for distributing supplies will depend much on the type of vocational program and the school setting. Following are some of the alternatives.

A supply room, or supply cabinet, can be located within the vocational laboratory.—Very large or bulky items may need to be stored on supply racks in the laboratory itself. Student attendants may be assigned on a rotating basis to dispense supplies and record changes. You may take personal responsibility for dispensing supplies; but if this is the case, the supply room should only be open for business for a short, specified time at the beginning of the laboratory period. If at all possible, the system should require students to fill out a requisition for supplies the day before so you can have the orders filled and ready to go. Though special circumstances may arise, it is important that you don't continually break off instruction in order to get some small item for a student.

A central supply room may be set up to serve several vocational programs in the school.—A paid clerk may be used to dispense supplies and keep the records. This arrangement relieves some of your load, but it can also cause some problems. Students may waste time getting supplies, and the clerk may not know exactly the material that they need.

Supplies may be kept in open cabinets or on shelves and racks, freely available to students as needed.—You can oversee the use of supplies generally to be sure they are not misused. This system may work perfectly well with mature groups where the supplies are fairly simple and easy to manage, and/or in programs where the supplies have little value outside the laboratory itself. Such conditions may exist in training programs for such occupations as keypunch operators, bricklayers, offset printers, or welders. Obviously, such an uncomplicated arrangement makes less demands on the teacher.

Policies for Laboratory Use by Others

Very often, schools with vocational programs are asked to share their facilities and equipment with other in-school and out-of-school groups. Community education classes, manpower development and training programs, summer school programs, and special adult short courses may require the use of vocational education facilities.

The sharing of these educational resources with the community is a vital aspect of the school's total educational function and should be done at every opportunity. However, sharing instructional resources should not impair the vocational program for which the resources were primarily provided. The needs of students who are in the regular day and evening programs have priority. The facilities and equipment should be available to them when needed, in the proper working order.

To ensure that a sound educational situation continues to exist, policies should be established beforehand to cover the use of the physical facilities by others. You may have to take the initiative in making known to the administration the need for such a policy. You may be asked by the administrator to assist in developing such a policy, or an existing policy may need to be updated and modified.

The following guidelines should prove helpful in developing policies for the use of the physical facilities and equipment by other groups.

- Any proposed policy for the use of facilities and equipment must conform to local and state regulations.
- The proposed policy should be approved and supported by the school administration.
- A schedule for the use of facilities and equipment should be drawn up. This schedule should be agreed to by all those concerned.
- Provision should be made for the security of facilities, equipment, and materials.
- Sharing of responsibility for lost, stolen, or damaged equipment or materials should be established.
- Provision for maintaining and cleaning the equipment should be made.
- Separate storage of projects and materials for each group should be provided.
- A complete inventory of tools, equipment, and supplies should be maintained.

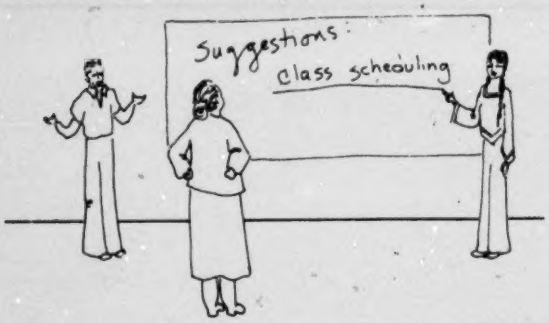
Scheduling Laboratory Use

Vocational education laboratories are usually

busy places. In order to derive maximum usefulness and efficiency from the facilities, the activities of the laboratory should be scheduled carefully. Attention should be given to scheduling vocational classes, scheduling units of instruction, and organizing students within a class so as to utilize all the available laboratory work stations.

If two or more vocational teachers are using the same laboratory for their classes, they need to have their class schedules planned to provide best use of the facility with a minimum of conflict. In most institutions, class scheduling is done by an administrator, not the teachers, but it is possible to provide input to the person in charge of scheduling. He or she should be informed of the special problems arising from having more than one teacher use the laboratory.

The teachers involved may be able to make positive suggestions as to the best class schedule. It may be possible, for example, to schedule the work load of two teachers so that one will teach a related class in a classroom while the other teaches in the laboratory, thus utilizing the available resources to their fullest extent.



In most vocational programs involving several areas of work, it is not feasible to provide each student with his/her own equipment. To attempt to do so would entail enormous expense and a great deal of space. It is, therefore, necessary for you to plan the work of the class so that each student is allowed a fair share of time to work with each piece of equipment. This may be accomplished by fixed time schedules, by having students work on a variety of learning activities, or by very informal scheduling as opportunities arise.

It is becoming increasingly important that every vocational student be provided the time and opportunity to work in all instructional areas in the program. In some occupational specialty areas (cosmetology and dental assisting, for example), state regulatory agencies require a designated number of hours of work in clinical situations (i.e., with actual patrons or patients).

In competency-based vocational programs, it is essential that students have the opportunity to develop the required degree of skill in all of the specified competencies of the occupation. In order for the teacher to certify student competencies, he/she must have observed the student performing the skill according to the predetermined criteria. It is, therefore, imperative for the teacher to manage the laboratory on a systematic basis so the necessary experiences take place and the learning occurs.

Coping with the management problems in a laboratory where several major learning activities are going on at the same time is demanding. Teachers who have been most successful at this are those who have planned and prepared for it. The problems and constraints of each vocational service area are perhaps unique, but there are a number of procedures you can follow that will help you to schedule laboratory activities effectively.

There may be several instructional areas in the laboratory where tools, equipment, and work stations are grouped for some major activity. Since all the learning activities do not need to take place at the same time, plan the term's work so that certain **work stations** are used for one type of activity at the beginning of the term, and another activity at the end of the term.

In order to get the school year off to a smooth and efficient start, select for the **beginning learning activities** those that can be done by the whole group at the same time. This means that the activities will probably have to be relatively simple and limited ones. There will have to be sufficient hand tools and work stations so all may work without hindrance. Students will complete these first activities at varying rates and can then be assigned a variety of continuing activities.

Because of the limitations of tools and equipment, it may be impractical to begin the class with only one activity. If several **different student activities** are to be started at the beginning of the term, delay actual laboratory work until a series of basic lessons or demonstrations have been given. Important and representative operations should be demonstrated in each of the activities that students are about to undertake.

When this method is used, there will be a considerable time lapse for some students between the time they receive group instruction for a task and when they actually have a chance to practice that activity at their work stations. You can minimize the difficulties by using the following techniques.

- Schedule activities to keep the time lapse to a minimum.
- Provide instruction sheets to help students remember the steps in the job.

- Provide individual and/or small-group mini-demonstrations to refresh the memory of students as they finally begin the activity.
- Have students who have successfully completed the activity help those who are just beginning.

Install a **work station rotation system** so that each student is provided a definite and predetermined number of days to work at each piece of equipment. The rotation can be by individual students or by small groups of students. The rotation period can be weekly or every two weeks. This system has some obvious and serious deficiencies, because all students do not work or learn at the same rate. However, where facilities are very limited, it may be a necessary solution.

Rotate students among the required work stations on the basis of **individual progress.** As a student achieves the competencies of one area, he or she is assigned a new area of work. This permits individual students to work at their own rate and continue until they have learned the necessary skills.

The movement toward individualized instruction, competency-based instruction, and open-entry/open-exit programs requires that students rotate work stations on an individual basis. In order to make this system work, flexible scheduling of students and a suitable record-keeping system are necessary.

Maintain a **progress chart** to keep track of student achievement and assist in implementing a work rotation system. A progress chart posted in the laboratory not only aids in devising work station assignments, but also keeps students informed about how well they are meeting the course objectives.

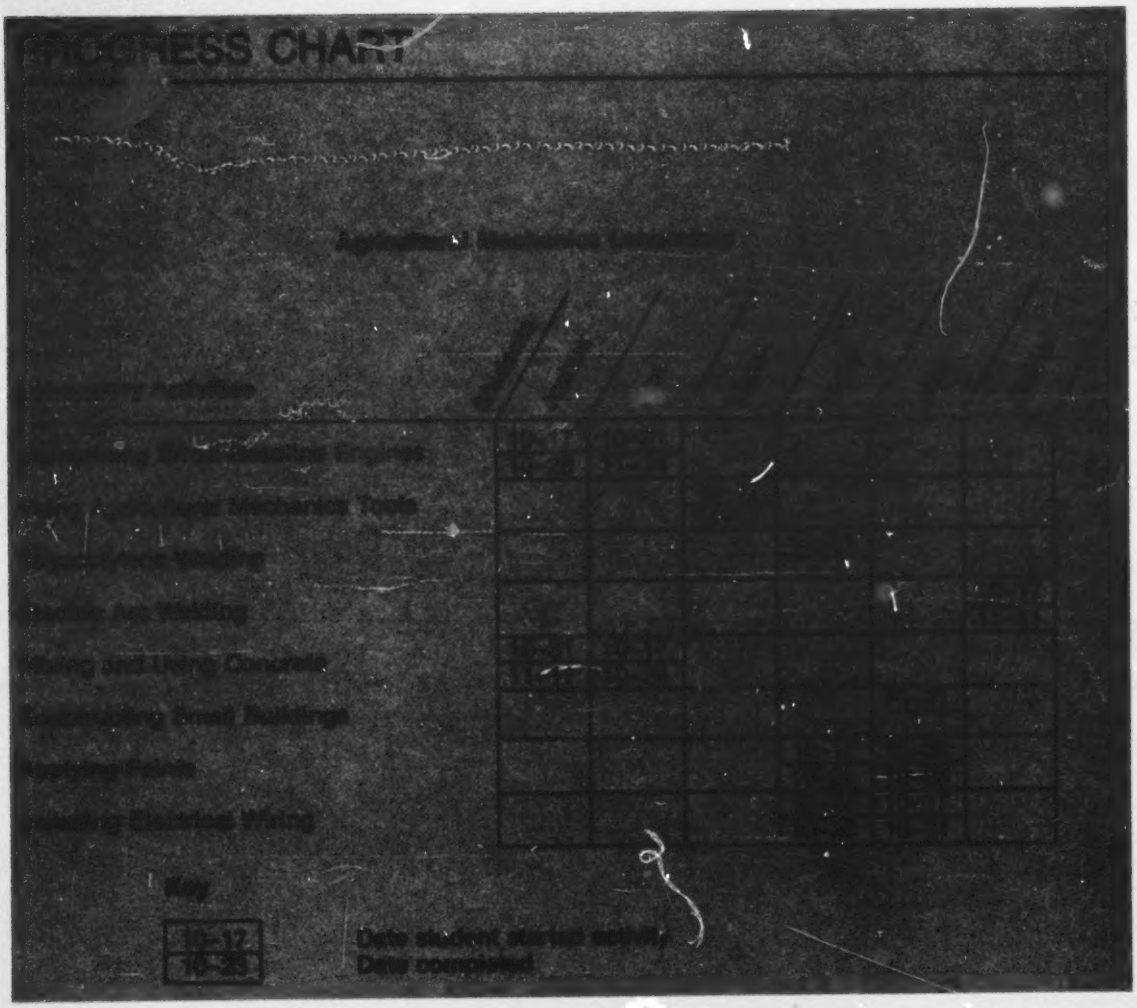
In a competency-based vocational education program, some form of progress chart (either posted or kept in your records) is essential in allowing you to record each student's achievement in a great number of occupational skills. A simple progress chart is shown in Sample 1.

You can provide a scheduled variety of **customer work** so students can fully utilize the available work stations. In programs such as television repair, cosmetology, auto repair, and dental hygiene, the instructional program depends on "live work" (i.e., actual customer service work).

You should schedule and organize live work on the basis of student instructional needs rather than on customer convenience. In auto mechanics, for example, if some students need learning activities in wheel alignment, and the equipment is not in use, you need to keep that work station operating by searching for suitable wheel alignment customers among school staff, students, or community members.

Provide **open laboratory time** for students. Periods of time when regular classes are not using the laboratory can be scheduled as open labs. This time is usually scheduled during late afternoon or evening hours. During the open laboratory time, students can come in on a voluntary basis to make up missed hours, work on personal projects, practice skills, or use equipment that is in heavy demand during the regular class period. You, or some other paid supervisor, must be on hand when the laboratory is open, but for the most part the work should be self-instructional. Schools with crowded class schedules or double sessions often cannot arrange for any unscheduled laboratory time.

SAMPLE 1



Optional Activity

For more information on storing tools, and for ideas that you may be able to apply in your own laboratory, you may wish to read Silvius and Curry, *Managing Multiple Activities in Industrial Education*, pp. 249–260.

The following items check your comprehension of the material in the information sheet, Managing the Vocational Laboratory, pp. 6–14.

SELF-CHECK

I. Essay:

Each of the four items below requires a short essay-type response. Please explain fully, but briefly, and make sure you respond to all parts of each item.

1. Discuss the following statement: "Good laboratory management greatly increases the potential for student learning in a vocational program."

2. What, if anything, is the relationship between the objectives of the vocational education program and the system of laboratory management that is installed?

3. What responsibility has the vocational teacher for the general environmental conditions (heating, lighting, ventilation, etc.) in the laboratory?

4. How can tools and instruments be controlled and safeguarded—and yet be accessible and useful to students working in the laboratory?

II. Critique:

Read the following description of two teachers' approaches to managing their respective laboratories, and **critique in writing** the teachers' performance. In your critique, include suggestions for how the teachers could improve their management procedures.

You have arranged to visit the Arcadian Area Vocational School to see two vocational laboratories and talk to the teachers who are responsible for the programs. Mr. Carl Yancy, the administrator in charge of instruction in the school, takes you down to the office machines laboratory. "I want you to meet one of our best teachers, Ms. Priscilla Thomas. Ms. Thomas runs the finest laboratory program in the country."

After Mr. Yancy leaves, Ms. Thomas begins to show you around the laboratory. The cabinets are painted lovely pastel colors, the floor is carpeted, the place is spotless. The teacher is obviously proud of the equipment, and with reason. "We just got this expensive machine recently. I demonstrate its use, but of course I don't let students use it because they might damage it."

You comment on the fine collection of reference materials you see on the shelves in Ms. Thomas' office.

"Yes," she replies, "the school has been generous with funds for library materials. I find it very helpful in planning my lessons."

In answer to a question about student participation in the management and maintenance of the laboratory, Ms. Thomas responds, "Students are indeed very valuable in helping to maintain the laboratory, and I use them whenever I can. Those two in the back of the room, for example. They finished today's assignment early, so I got them to straighten the supply cabinets."

You inquire whether she is planning any changes or additions to the program."No, not really. We should have a stencil duplicator, I suppose, because many of the small businesses in the area use them, but it is so messy, you know."

You thank Ms. Thomas for an instructive visit, and make your way to the back of the school to see the laboratory for farm equipment maintenance.

It is actually just a large shed next to a field. The only wall is where the shed meets the school building. It hardly deserves the term "laboratory," you think. You see the teacher outside with a group gathered around a tractor.

He makes the introduction. "You're the visitor from the college, and I'm Al Fresco," he booms.

You tell him you are there to get ideas about managing laboratories, and he cuts in, "Don't believe all that stuff you read in those teacher education modules; it can't be done. You always have too many students and not enough money. It takes two weeks just to get a faucet fixed. We do have good ventilation out here though," he laughs. "When it rains we go inside and have a related lesson."

Mr. Fresco talks nonstop as he shows you around. "The important thing is to keep the students busy . . . get plenty of jobs set up so they can practice maintenance operations . . . keep all the equipment running even if you have to come in Saturdays to do it. Mr. Yancy gets on me sometimes about how the shop looks, but after all, farm mechanics isn't a white-glove occupation. I really should build a new tool panel . . . haven't lost a tool in a couple of years though . . . students want to use the tools, so they take care of them . . . we don't have a cleanup organization . . . everybody just pitches in to get the job done, and I try to see that one person doesn't always get the dirty work. Supplies? . . . everybody just uses what he needs . . . no problem, except things are hard to find sometimes."

You leave Mr. Fresco's lab at the end of the hour, worn out and slightly confused about laboratory management. You spot a convenient tree under which you can sit to collect your thoughts and come to some conclusions

Compare your written responses on the Self-Check with the Model Answers given below. Your responses need not exactly duplicate the model responses; however, you should have covered the same **major** points.

MODEL ANSWERS

I. Essay:

1. Even experienced teachers are sometimes astonished to find that students can learn under very poor conditions if they are motivated enough. There is, however, no doubt that students will learn more efficiently and will want to continue learning if conditions are attractive, comfortable, and convenient. In a laboratory that is well managed, the teacher attempts to provide just the right environmental setting for learning.

   Physically, students should be able to see and hear instruction if they are to learn. The temperature, humidity, and ventilation need to be such that students are comfortable and can concentrate on the job at hand. The sound level in the laboratory should be low enough that it does not cause tension, depression, or short attention span—conditions that interfere with learning.

   Learning is enhanced if students feel that they are in an environment where success is possible. If the tools of learning are accessible and attractive, students will tend to want to use them. If the surroundings are attractive and orderly, students will be stimulated and more productive. A laboratory that is a model of occupational management will encourage students to copy the model and develop good work habits and attitudes of their own. The vocational teacher who skillfully manages a vocational education laboratory will be fostering learning at the same time.

2. The ultimate goal of any vocational education program is to prepare students to successfully enter the occupation for which they are being trained. Most of the program's objectives lead to that goal, and these objectives deal with the specific knowledge, skills, and attitudes needed in the occupation. Every laboratory management plan should be designed to help students reach the goal of entering the occupation.

   Ideally, all the management activities that affect students should be planned to further one or more of the objectives. Even an ordinary and routine task like cleaning the equipment should be related to a needed skill or attitude such as the need to keep tools and equipment clean on the job. Purchasing supplies, for example, should be done in such a way as to provide the best material available for student laboratory learning activities.

   It is not always possible to draw a direct relationship between program objectives and management procedures. Some things must be done just to fulfill administrative or business regulations and may actually tend to interfere somewhat with program goals and objectives.

   It is very important, however, for you to prevent personal convenience, whims, or supposed tradition from influencing laboratory management design. All plans, procedures, and regulations should be subject to scrutiny to be sure

that, as much as possible, each one promotes the objectives of the program and assists students in achieving their educational and personal goals.

3. The teacher's responsibility for providing proper environmental conditions in the laboratory will vary considerably from school to school. In some buildings, heating, lighting, and ventilation are completely controlled by the custodial staff, or by automatic devices that don't seem to take orders from anyone. In that case, there is not much the teacher can do except to be aware that the system is working properly and to notify the right person if the system malfunctions.

   In other schools, the teacher has individual control of heating, air conditioning, general room ventilation, exhaust fans, lighting equipment, windows, and shades. A good deal of personal discretion is then possible in providing a good laboratory environment.

   No matter what the school setting or conditions, the vocational teacher has a real responsibility to make every effort to provide the best possible environment in the laboratory. It is always possible to work for improved conditions, to cooperate with other teachers to minimize noise interference, and to organize laboratory activities to avoid environmental difficulties. The health, safety, comfort, and learning processes of students (and teacher) depend on it.

4. The simplest way to keep tools and instruments from getting lost, taken, or damaged is to keep them tightly locked in a storeroom and never let students get their hands on them. The easiest way to provide students with convenient access to tools (at least for a while) is to scatter the tools on the various work stations within easy reach. Obviously, neither of these "solutions" is desirable or feasible; some compromise or combination of methods is needed.

   The basic principle of good tool control is to provide a designated storage spot for every tool . . . only one place for each tool, and only sufficient places for the tools available. When the particular tool or instrument is not in actual use, it is to be in its storage holder. You should make a quick and accurate inspection of the tool panels at the beginning and end of every laboratory period (and even during the period) to be sure all is in order.

   If such a system is carefully worked out and presented to students, they will cooperate in making it function because it is to their own advantage. It is very important to achieve this wholesome and cooperative attitude about tool care, and avoid a kind of "police state" atmosphere in which there is mistrust and antagonism between teacher and students.

II. Critique:

There is no doubt that both Ms. Thomas and Mr. Fresco are sincerely concerned with helping students learn through laboratory experience. Their approaches to this goal are quite different, however.

Ms. Thomas seems to think that a beautiful and smoothly functioning laboratory is an end in itself. She appears to get a great deal of personal satisfaction from managing such a laboratory. Her students, too, probably enjoy the fine setting in which they work, though they must feel rather restricted sometimes. They might learn even more if they were allowed to use all the equipment that was intended for them in the program.

While her concern for protecting the community's investment is commendable, if Ms. Thomas gives adequate instruction, surely the chance that students will damage the equipment is minimal, and worth taking in view of the benefits involved. The same is true of the reference library because it, too, should be available to students, not just to the teacher.

It is unfortunate that the teacher's determination not to include an occupational process in the program was made on the basis that it is "so messy." The training value to students, not the effect on the appearance of the laboratory or the convenience of the teacher, should be the deciding factor.

In another way, also, Ms. Thomas seems not to have thought through the needs of her students. She is **using** two of them to straighten cabinets for her—though this might be hard to justify in terms of use of students' time or training for skills needed in the occupation. It is also a very poor "reward" for students who are conscientious and finish their assignments quickly. Surely some interesting additional laboratory activity would have been better.

It is significant that Mr. Yancy, the dean of instruction, is impressed with Ms. Thomas as a teacher. The outward evidences of success are very apparent, but both Mr. Yancy and Ms. Thomas should look more deeply at the laboratory program and assess its effectiveness in meeting the objectives of vocational instruction.

Mr. Fresco's "laboratory" is a different situation altogether. The facility itself is poor, the general conditions are disorderly, and there doesn't seem to be much system to the whole operation. The attitudes that Mr. Fresco expresses are in some ways disappointing, though perhaps somewhat justified. There is much that could be done to improve the laboratory.

At the same time, students do appear to be learning and enjoying it. Mr. Fresco keeps them busy with productive work, keeps the equipment in good operating order, and provides the tools they need in order to do the job. From what he says, they cooperate with him and with each other—certainly a good atmosphere to have in any laboratory.

Mr. Fresco seems to have a good point when he implies that the standards of orderliness in the vocational laboratory must be realistic in terms of the occupation involved. He appears to be making the best of a difficult situation.

With some additional work, the management of the laboratory could be improved. Mr. Fresco could probably get the school to improve the facility if he had the support of Mr. Yancy. He could build that enclosed tool panel to show his interest and concern.

The students' energy and enthusiasm could be used to greater effect if their responsibilities were organized to include not only cleanup tasks, but lab maintenance duties and some self-government as well. Even fixing a faucet is within the scope of student skills in a farm mechanics program. Mr. Fresco seems to have great potential as a teacher—maybe all he needs is to complete a few well-chosen teacher education modules.

LEVEL OF PERFORMANCE: For parts I and II, your completed Self-Check should have covered the same **major** points as the model responses. If you missed some points or have questions about any additional points you made, review the material in the information sheet, Managing the Vocational Laboratory, pp. 6–14, or check with your resource person if necessary.

NOTES

Learning Experience II

OVERVIEW

Activity

Read the following information sheet for suggested practices in maintaining an inventory system for a vocational laboratory. As you read, attempt to relate each of the main points to laboratories in your own occupational specialty.

INVENTORY CONTROL SYSTEMS

Most vocational laboratories contain a great variety of supplies for student use and many pieces of expensive equipment. Adding together the value of all these items results in an impressive sum of money. You are responsible for all of this, and must keep track of it. In order for the task of controlling supplies and equipment to be done accurately, and with as little expenditure of your time and energy as possible, systematic inventory procedures should be used.

It is important for you to know at all times what supplies are in stock in the laboratory, and what tools and equipment are located in the facility. It is the purpose of a laboratory inventory system to keep a record of these items. The type and complexity of the inventory may be somewhat different for each program, but all vocational programs should have an accurate and current record of their supplies and equipment. The principles of maintaining an inventory are basically the same for all vocational programs.

Inventory records are needed in order to prepare budgets for the coming school year, to wisely purchase replacement supplies, to plan for the purchasing of additional equipment, and to provide for the orderly transfer of responsibility from one teacher to the next. Well-kept records allow you to know where every item is located, thus helping to control loss due to carelessness or theft. At the end of the year, inventory records provide you with the documentation needed to report a year of efficient laboratory management.

Supply inventories help you plan ahead, so laboratory supplies are available when students need them. Having adequate supplies available helps to avoid the waste of the students' time or the necessity of changing instructional plans. If the inventory system includes maintenance records for equipment, the maintenance program is made easier and more efficient.

Any inventory system to be adopted must fit the needs of the vocational laboratory in which it is to be implemented. You will probably wish to select a basic system and tailor it to your particular situation. Not only do vocational programs vary, but individual school systems may have their own requirements and regulations, and local administrators may expect specific information in inventory reports.

A complicated inventory system requiring the use of data processing equipment is seldom necessary for vocational laboratories. A simple and flexible system requiring a minimum amount of maintenance time is usually quite satisfactory.

There are laboratory supply inventories and equipment inventories. Each will require its own forms and procedures. It is not always easy to differentiate between "supplies" and "tools and equipment," however. In general, **supplies** are defined as things that are **consumed** or **destroyed** in the course of their use (e.g., typewriter ribbon, flour, paint, cement, marking pen). **Tools and equipment** are **not consumed,** but last indefinitely with proper use (e.g., pliers, scissors, calculator, spray gun, microscope).

The dividing line is not so clear with items that may last for years or may be used up or destroyed very quickly depending on circumstances (e.g., drill bits, knife blades, metalworking files, grinding wheels). Some school systems define supplies as items expected to last three years or less. Others define supplies as items that cost $10 or less per piece. Before you set up an inventory system, you will need to determine a definition for supplies and for equipment.

When you arrive at a school to take charge of a vocational program, one of the first things you should do is to **take a complete inventory** of all tools, equipment, and supplies on hand. If there is an inventory record left by a preceding teacher, every item on this record should be checked very carefully.

Any discrepancies between the old inventory and what is actually found in the laboratory should be noted and the information furnished to the school administration.

By going over the inventory conscientiously, you will (1) have an accurate record for the beginning of the year, (2) know what needs to be done to get all the equipment ready for use, and (3) avoid future misunderstanding as to the amount and kind of equipment that is in the laboratory.

At the end of every school year, after all student activities in the laboratory are over, a complete inventory should again be taken. Every piece of equipment that was on hand at the beginning of the school year must be accounted for in some way. Each item should be noted as having actually been seen to exist. It is not enough to check in an item on the inventory because you know it must be around someplace—or you think you remember seeing it a while back.

Items no longer in the laboratory at the end of the year should be accounted for (e.g., written notes in your file as to how they were disposed of). They may have been sold or traded in, cannibalized for parts, transferred to another laboratory, discarded, destroyed, or lost. Items new to the inventory should also be noted as having been purchased, acquired as gifts, or received as transfers from other school programs. A copy of the equipment inventory report should be kept in your files, and another copy furnished to the school administrator.

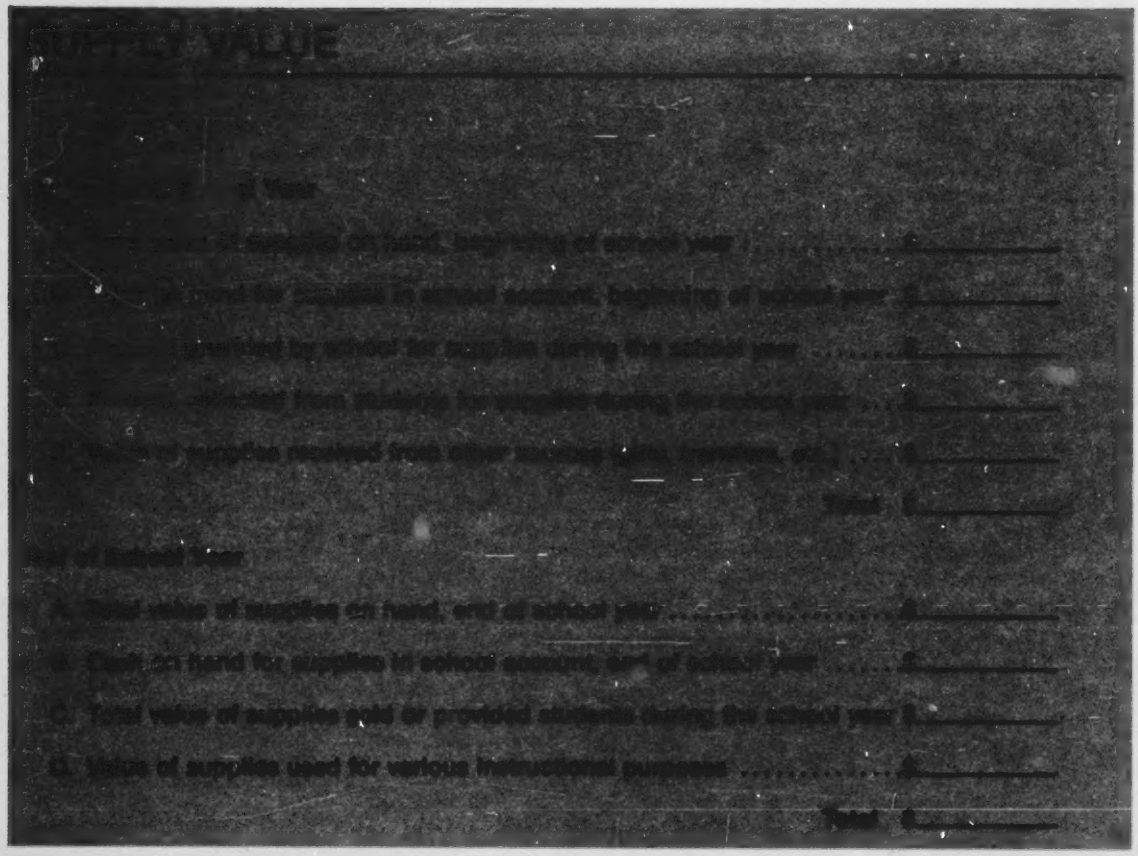
An inventory of laboratory supplies should also be taken at the end of the school year. The supplies on the shelf or in storage should be accurately counted and entered on an inventory sheet. The quantity on hand of each item should be multiplied by the unit cost for that item, and the total entered on the sheet. Finally, the value of all supplies should be added together to determine the total inventory value. An example of an inventory sheet is shown in Sample 2.

The actual task of taking the supply inventory should be done at a time when there are no distractions or interruptions so the job can be done accurately. It often helps for two teachers to work together—one counting the quantity of the item and calling it out, the other entering the number on the inventory sheet and verifying it. Dependable students can help take the inventory; it may be a very useful occupational competence for them. The final responsibility for the inventory is, however, the teacher's.

SAMPLE 2

You and the school administrators will want to have an idea of how the laboratory supply money has been spent during the school year. It is important to know that all school funds are accounted for, and are represented either by cash on hand in the school accounts, or by supplies on hand in the laboratory. It is possible to get an overall picture of the handling of supplies by calculating totals for the items shown in Sample 3.

SAMPLE 3



The total of the second set should be compared to the total of the first set. Generally, the two totals should be equal. Any difference between the two should be accounted for. If the end-of-year total is lower, it may indicate that (1) laboratory supplies have been used for teacher demonstrations, (2) students have not been charged enough for supplies they purchased, (3) there has been unauthorized use of supplies, or (4) there has been loss by theft. With the figures in hand, you have some basis for determining how well supply stocks have been managed, and for developing future management procedures.

You should develop or adopt a system that provides a **running inventory** of tools and equipment. There needs to be provision for adding new items and deleting obsolete or unusable tools and equipment at any time. It is also helpful if the inventory form provides information about the source of the piece of equipment (e.g., date and from whom purchased, gift and giver, transfer, etc.), and a record of its maintenance or repair.

A simple **file card system** is probably suitable for all vocational laboratory inventory needs. Such a system is easy to use and has great flexibility. File cards for each individual piece of equipment can be removed, replaced, or changed as needed. Somewhat more work is required to set up a card system than to simply make a list of items, but

the initial effort is easily justified because each card may be usable for many years.

To set up the card system, you must develop or select a card format to be used. Each item of equipment will be represented by a separate card, and the information on the card will usually include the following.

- item name
- type or model
- serial number
- source, cost, and date acquired
- condition of equipment
- dates of scheduled maintenance
- repair record
- other pertinent data as needed

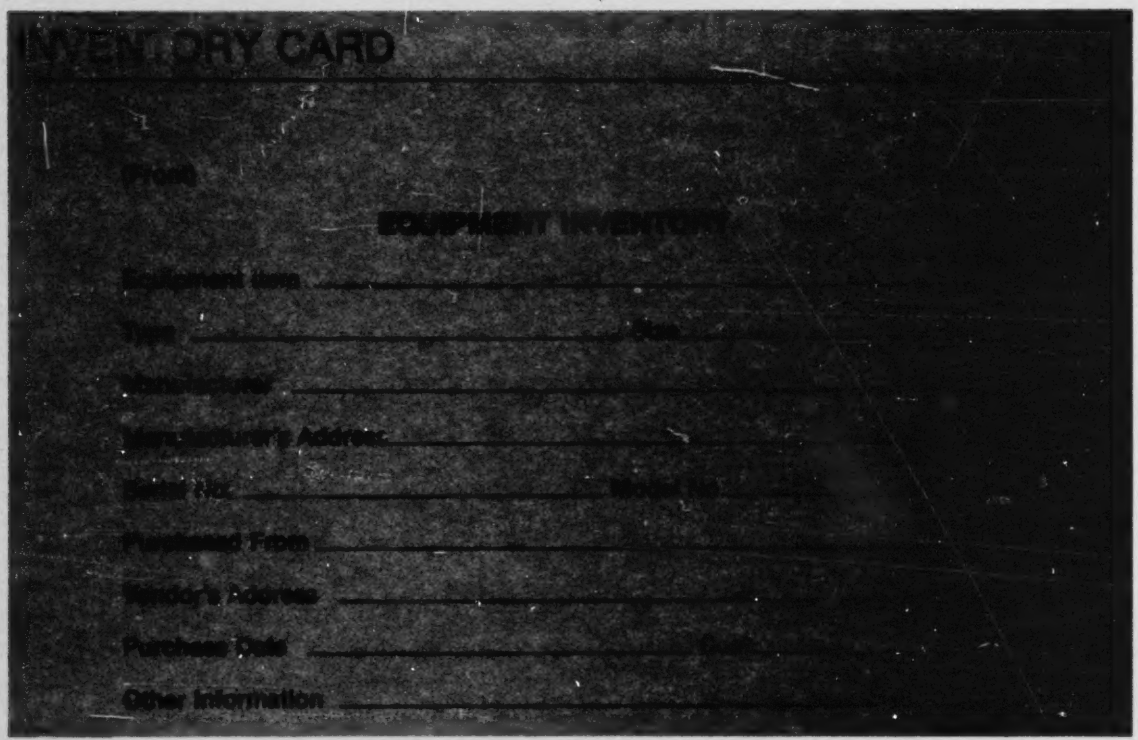
The cards may be either 3 × 5 or 4 × 6 inches in size, printed with the desired format. Index cards are available in several colors that may be useful for color coding different categories of tools and equipment. A 4" × 6" equipment inventory card format, showing the front and back, is shown in Sample 4. A card format suitable for hand tools and small instruments is shown in Sample 5.

Once the card system is set up, the only time a new card needs to be prepared is when a new item of equipment is added to the laboratory. If an item is removed from the laboratory inventory, a note is made on the card about how the equipment was disposed of, and the card is moved to the inactive file. It is necessary to keep such an inactive file so that if at any time a question is raised as to what happened to the equipment, the answer will be available and documented. The cards themselves should be organized in a durable file box and kept in a secure place.

Some vocational laboratories may need to develop very special inventory devices to control certain laboratory items. In health services programs, for example, drugs subject to abuse will need to be controlled with an inventory security system similar to that used in a hospital. In such a system, the materials are stored in a locked cabinet with only the teacher having the key. The teacher dispenses the material, and the student signs an inventory sheet which records the type, exact quantity, date, and time the material was received.

Vocational programs using precious metals may set up a running inventory card system in which the teacher records the amount whenever any are given out, so that at any given time the exact quantity of the material remaining in stock is known. Valuable or delicate tools may need to be signed out by the student whenever he/she requires their use. Some large school systems may have developed a computerized inventory system for laboratory equipment. In any case, you should plan and construct an inventory system that will meet your particular needs.

SAMPLE 4


INVENTORY CARD

(Front)

EQUIPMENT INVENTORY

Equipment Item _____

Type _____ Date _____

Manufacturer _____

Manufacturer's Address _____

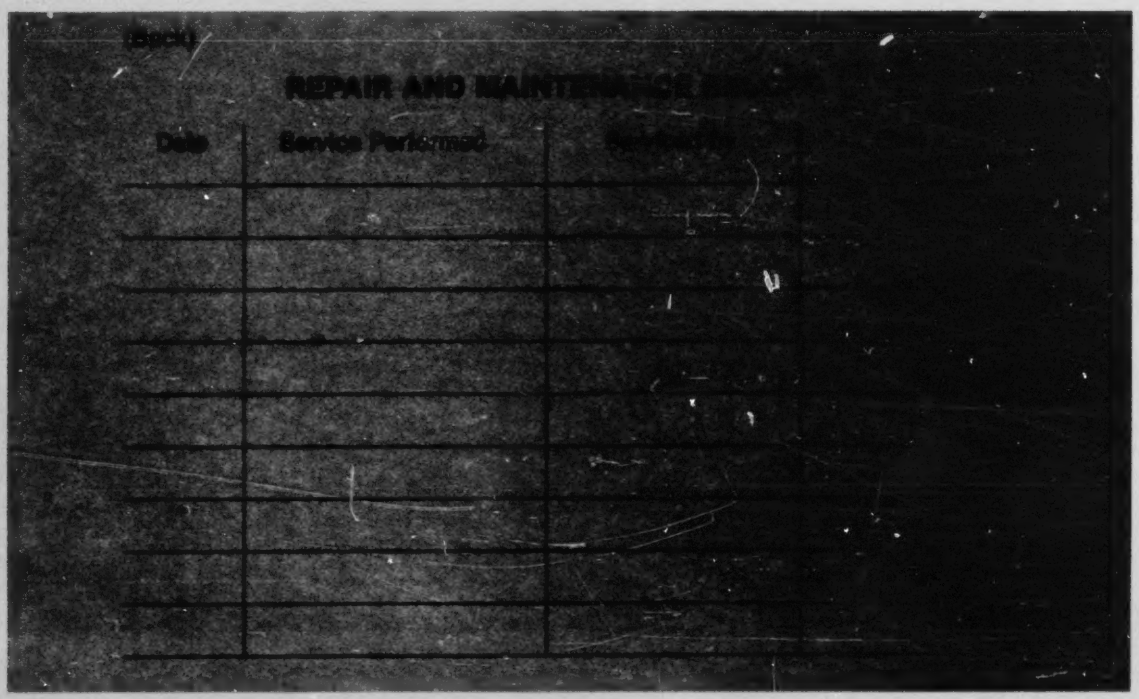
Serial No. _____ Model No. _____

Purchased From _____

Vendor's Address _____

Purchase Date _____ Cost _____

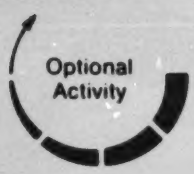
Other Information _____


(Back)

REPAIR AND MAINTENANCE

Date	Service Performed	Remarks

SAMPLE 5



For more information on organizing an inventory control system, you may wish to read Storm, *Managing the Occupational Education Laboratory*, pp. 83–99.

To get firsthand information about inventory control problems in your own occupational specialty, you may wish to arrange through your resource person to visit a laboratory in the area and examine the inventory control system in use. During your visit, you may wish to discuss with the teacher responsible for the laboratory the special problems of inventory control, and the solutions he/she has found for them.

From your own occupational specialty, select a single instructional area (e.g., in a cosmetology program, manicuring; in auto mechanics, tune-ups; in graphic arts, reproduction photography; in foods preparation, baking). Develop a complete plan for an equipment inventory system for that one area. This will include—

- listing all the tools and equipment for the area
- selecting or developing a format for inventory cards or sheets
- developing a plan of procedures for the maintenance of the system

After you have developed your plan, use the Inventory Control System Checklist, pp. 31–32, to evaluate your work.

INVENTORY CONTROL SYSTEM CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following performance components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

Name _____

Date _____

Resource Person _____

LEVEL OF PERFORMANCE

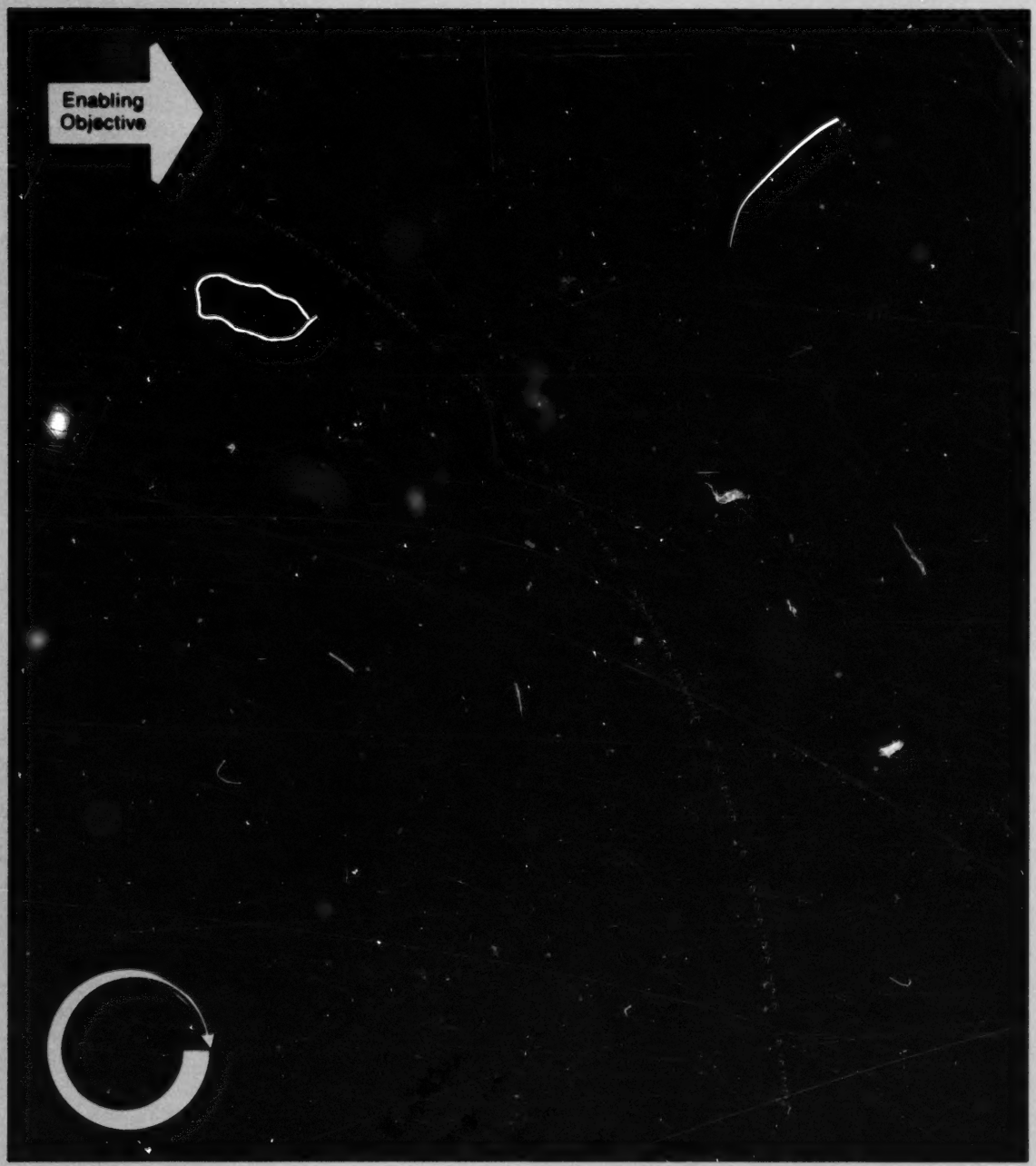
	N/A	No	Partial	Full
The equipment inventory control system:				
1. includes all the tools and equipment needed by the student to work in that area of instruction	☐	☐	☐	
2. utilizes inventory sheets or cards that include all information necessary and helpful for inventory control in the specific occupational specialty	☐	☐	☐	
3. provides a relatively easy way to add or delete items on the inventory as necessary	☐	☐	☐	
4. includes information as to where all items are located	☐	☐	☐	
5. defines and maintains a clear distinction between "tools and equipment" and "supplies"	☐	☐	☐	
6. is organized simply and logically in some form of file box or notebook	☐	☐	☐	
7. includes, as appropriate, special procedures for controlling expensive, delicate, or hazardous items by:				
a. providing security for the items	☐	☐	☐	
b. providing information on student use of the items	☐	☐	☐	
8. is clearly organized, and easy for others to understand	☐	☐	☐	

	N/A	No	Partial	Full
9. is relatively easy for the teacher to keep current, in that:				
a. during the school year it requires little or no attention except when there is a change in equipment	☐	☐	☐	
b. if a change is necessary, only the card or sheet for that item is affected	☐	☐	☐	
c. it requires only a simple check during beginning-of-term and end-of-term inventory procedures	☐	☐	☐	
10. includes a plan of procedures that provides for:				
a. at least one full inventory per school year	☐	☐	☐	
b. an inventory check at the beginning of the school year	☐	☐	☐	
c. some form of inventory report for the school administration	☐	☐	☐	

LEVEL OF PERFORMANCE: All items must receive FULL, or N/A responses. If any item receives a NO, or PARTIAL response, review the material in the information sheet, Inventory Control Systems, pp. 24–30, revise your plan accordingly, or check with your resource person if necessary.

Learning Experience III

OVERVIEW



Read the following information sheet for recommended procedures for setting up and maintaining an equipment maintenance system, and suggested forms to use.

LABORATORY EQUIPMENT MAINTENANCE SYSTEMS

If students are to learn the skills of their chosen occupation at maximum efficiency, the tools and equipment in the laboratory should be in their best possible condition. Students cannot do good work with poor equipment. Neither will they develop positive attitudes toward the care and use of the tools of their trade if the tools in the laboratory are badly maintained. Student safety in the laboratory may well be jeopardized if electrical wiring is old and frayed, machine parts are broken or missing, or cutting tools are not sharp. There is a great deal of truth in the old saw, "A dull tool is a dangerous tool."

You have a stake in laboratory equipment maintenance that cannot be ignored. A unit of study can't be planned and presented properly if the needed equipment is out of order. A skills demonstration lesson must be supported by well-functioning tools and equipment if it is to proceed smoothly and effectively. You also have ultimate responsibility to the school to see that laboratory equipment is properly cared for, controlled to prevent loss, and repaired when necessary. The way this responsibility is delegated among staff is not the same in all schools, but the obligation remains nonetheless.

The Teacher's Responsibilities

There are a number of duties involved in maintaining laboratory tools and equipment. You may be expected to do some of the work yourself or may work cooperatively with others to take care of some of the equipment. Or, you may simply have the task of seeing to it that a major maintenance job is completed by a service specialist. You may choose to accomplish these tasks on a "piecemeal" basis (i.e., taking care of each situation or maintenance task as it arises). However, it will be done much better, and involve much less of your time and effort, if the whole procedure is planned and carried out systematically.

One of your tasks is to **make an inspection** of all the equipment in the laboratory **regularly and frequently.** For some delicate or hazardous equipment this may have to be done daily, while for other equipment a monthly check is all that is required. It may be sufficient to give a quick and expert inspection of the critical areas of the equipment (such as the gas regulators and hoses of an oxyacetylene welding outfit) to be sure all is well. Complex and delicate electronic equipment may require a more thorough inspection and routine tryout of the controls.

If everything appears to be in order, no special care is indicated until the next scheduled maintenance service, but if the inspector detects possible trouble, it should be dealt with immediately. You will have to draw on your expertise to determine how often routine inspections should be done, how thorough they must be, and what parts should be inspected.

A second aspect of your maintenance responsibility is to **provide routine care** for laboratory equipment. The purpose of routine maintenance is to prolong equipment life, prevent breakdowns, and keep things in top working condition. This is often called "preventive maintenance" because its purpose is to prevent wear and breakdowns rather than just repair out-of-order equipment. This may include such operations as regular lubrication, general cleaning, minor adjustment, replacement of disposable parts (such as air filters), or sharpening of cutting edges.

Usually, the manufacturer of each piece of equipment will have worked out a maintenance schedule for it, and will have provided detailed instructions in the operations manual. These manuals become important parts of your maintenance files. Some equipment has very strict requirements for maintenance, even to the point of being subject to state or local law. For example, X-ray machines must be tested for radiation leakage and dosage at set intervals, and fire extinguishers must be recharged regularly. Air compressor pressure tanks should be drained of water on a scheduled basis.

Even with good maintenance service, some pieces of equipment have been known to break down. **Minor repairs** are frequently needed to keep

the laboratory functioning. Belts will break, switches will become defective, and lamps will burn out. When this happens, it is important to get the equipment working again as soon as possible. There are few things more discouraging to students than to have their laboratory work frustrated by out-of-order equipment.

You may make minor repairs if you have the necessary time and skill, or they may be done by service personnel. In either case, you must take steps to get the equipment back in operation quickly. It is often possible to make rapid repairs if a stock of common spare parts is maintained in the laboratory. The stock may include parts known to require occasional replacement, such as electric fuses, lamps, switches, drive belts, and hoses.

Major repair to equipment is another one of your responsibilities, though the actual work is almost always done by outside service personnel. You must recognize the need for the service, then take steps to see that it is done. This may involve writing a repair requisition, calling in the repair service, and checking the finished job to be sure it has been properly done. It is up to you to make sure that the job gets done, even if there are difficulties and delays due to required school procedures or busy repair services.

There is no universal pattern for designating who is to do the actual work of maintaining and servicing the equipment in vocational laboratories. The task is given to various persons or agencies, depending on the nature of the vocational program and the policies of the institution. Usually, teachers in every area are expected at least to do **day-to-day inspection, general cleaning,** and **minor adjustments.** If it is part of their occupational learning experience, students are often involved.

If the laboratory is highly specialized, there may be no one available to service it except a teacher who has the required knowledge and experience. Sometimes the teacher takes on such noninstructional service and repair work for additional compensation.

In larger institutions and school systems, the maintenance of common equipment is handled by the school staff. It may be done by the custodial staff, school maintenance staff, or the school system maintenance department. The work may be done whenever necessary without charge to the vocational program, or it may be charged against a budgeted amount. An internal request or school work order must usually be prepared and sent to the appropriate department to get the work done.

The competence of the maintenance personnel, and the consequent quality of the service work, can be expected to vary widely.

Maintenance of the building and the laboratory facility itself is always the responsibility of the institution's or school system's staff. Such things as lighting fixtures, water coolers, ventilating fans, gas supply lines, and plumbing fixtures belong in this category. You are not usually expected to provide service for these items, nor do repair costs come out of the vocational program budget. Other items of equipment, such as electric conductors to machines (bus bars) or dust collectors, are not so clearly categorized and may be considered as building equipment or vocational laboratory equipment.

Commercial repair services are usually called in for major equipment repair jobs or for work on specialized equipment. Often this requires cost estimates and a special purchase order before the work is begun. Some vocational service areas, notably home economics and business and office, commonly utilize maintenance service contracts for their equipment. The school enters into a yearly contract with a commercial firm which undertakes regular specified routine maintenance, adjustment, and repair. Your responsibility in this arrangement is to make sure that the commercial service lives up to the terms of the agreement and that the service is performed satisfactorily.

Student Participation

Vocational teachers do not fully agree as to whether, or how much, students should be in-

volved in maintaining laboratory equipment. Some teachers view such activity as exploiting students, or as possibly hazardous to the equipment because they feel students are not capable of performing such tasks. Other teachers incorporate equipment maintenance assignments into the curriculum, making it of equal importance with the other laboratory learning activities.

The types of maintenance responsibilities you assign students, and the complexity of their tasks, will depend on the nature of your occupational specialty and the organization of the program. If workers in the occupation are expected to maintain their equipment on the job, opportunity to learn this competency should be given in the vocational education program. If caring for tools and equipment in the laboratory will encourage the development of desirable work habits and attitudes, then the experience is a worthy one.

Students in mechanical and machine repair training programs (such as office machine repair, small engine repair, refrigeration, machine shop, and automotive mechanics) clearly should benefit from helping to maintain laboratory equipment. Students in the field of electronics will probably find it essential that they know how to adjust, align, and repair electronic test equipment when they get out on the job. On the other hand, a data processing program should probably not involve students in maintaining the keypunch, sorting, or other machines used in the program because these duties are not expected of them on the job.

In all programs, students should be involved at least to the extent of **checking** the equipment **for malfunction, wear,** or **breakdown.** They should be taught to note possible hazardous conditions and report them to the instructor. They should certainly

learn to recognize the differences between a properly functioning piece of equipment and one that is out of adjustment, overstressed, or damaged.

If students are to participate in laboratory maintenance, the effort must be planned and organized. Group and individual lessons on maintenance procedures may need to be given. Practice should be provided, along with careful supervision by the teacher. This may be done as the opportunity arises during the school term, or it may be part of a formal unit of instruction. Student responsibility for maintenance may also need to be included in the laboratory cleanup schedule, with a rotating assignment of individuals or a small crew to the duty of daily equipment maintenance.

The Maintenance Plan

Maintaining the laboratory equipment will take less of your time and energy and will be more efficiently done if a maintenance plan for the laboratory is developed. Some extra effort will need to be expended to develop the plan and materials, but this will be repaid many times over the years. The maintenance plan will differ in content and complexity in each particular occupational specialty, but generally the development processes will be the same for all programs.

The first step is to prepare a list of **all** the pieces of equipment in the laboratory that require regular maintenance of any kind. This includes large machines and small equipment or test gear. For each piece of equipment on the list, prepare a listing of the **maintenance services required** and the **service interval** (e.g., maintenance required once a week, at the end of each semester, after 100 hours of use, or when a specified condition is reached).

The information for determining service operations and intervals can be found in equipment manuals, by asking other teachers who have similar equipment, or from your own background of experience.

Maintenance requirements of school laboratory equipment is not always the same as that of equipment used in an industrial or commercial setting. School equipment may be somewhat lighter in construction, and school use may place different demands on the equipment than use in industrial production. You will want to follow the manufacturer's recommendations carefully, modifying only as experience shows is necessary.

It is very helpful to construct a **maintenance file** or **maintenance handbook** for the specific laboratory. This consists of a card or sheet for each piece of equipment with the necessary service operations and intervals listed. There should be spaces on the sheet for entering the dates that maintenance service was done, the initials of the person who did the work, and any remarks that will help you keep track of the condition of the equipment (e.g., "check oil level in gearbox next time," or "batteries replaced 9/14/76").

Other information on the sheet may include the name and address of the vendor or parts supply house, the name of the service person to call, adjustment specifications, or other pertinent data. An example of such a sheet is provided in Sample 6.

The maintenance sheets may be kept in a three-ring binder or the cards in a file box. The notebook format is particularly handy because it can be carried to the equipment and the operations can be checked off as completed. Once the handbook is made up, it will serve a long time, and any necessary changes can easily be made by adding or replacing individual sheets.

After the handbook has been produced, the next step in developing a maintenance plan is to determine **who is responsible** for each duty area. You will probably reserve some specific tasks for **yourself,** certain of the tasks may be delegated to **students,** other responsibilities can be covered by **school maintenance personnel,** and still others to outside **commercial or industrial firms.**

A list of the persons or agencies concerned with the equipment maintenance should be drawn up, and the responsibilities for each one assigned. Obviously, the assignments should be made in accordance with school policy and practice, and with the knowledge and agreement of the individuals involved. A calendar or schedule of equipment maintenance activities can be worked up, showing the dates on which the jobs are to be done and the persons or agency who are to do them.

In some school systems or institutions, it may be necessary to prepare a **budget** as part of the maintenance plan. If service and repairs are to come out of program funds, then adequate funds need to be set aside for this purpose. The budget should categorize the expenses (e.g., service by outside firms, service by school maintenance department, repair parts, replacement fluids, etc.) and estimate the amount to be needed for each category for the following school year.

The estimates can be drawn from your own experience, the experience of other teachers, and/or the equipment suppliers. If there is a maintenance contract for service, that cost will be known and can be included in the budget. If possible, a contingency fund, calculated as a small percentage of the budget, should be included to take care of unforeseen circumstances. Each year, as the laboratory equipment increases in age, the maintenance budget should be increased to cover the cost of service and repair.

SAMPLE 6

For more information on organizing a laboratory maintenance system, you may wish to read Storm, *Managing the Occupational Laboratory*, pp. 101–140.

You may wish to arrange through your resource person to visit a laboratory in your own occupational specialty to see an equipment maintenance system in operation. During your visit, you may wish to discuss with the teacher responsible for the laboratory the special needs and problems of maintaining equipment in your vocational area, and the maintenance procedures he/she has found helpful.

From your own occupational specialty, select a single instructional area (e.g., in a cabinetmaking program, wood finishing; in office machines, duplicating). Develop a complete plan for an equipment maintenance system for that one area. Include in your plan—

- a listing of all the equipment for the area
- the maintenance procedures for the equipment
- a record-keeping system
- an outline of procedures to maintain the system

After you have developed your plan, use the Maintenance System Checklist, p. 41, to evaluate your work.

NOTES

MAINTENANCE SYSTEM CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following performance components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

Name _____

Date _____

Resource Person _____

	LEVEL OF PERFORMANCE			
	N/A	No	Partial	Full
The equipment maintenance plan:				
1. includes all the equipment needed by students to work in the area	☐	☐	☐	
2. includes all equipment maintenance procedures as recommended by the equipment manufacturers	☐	☐	☐	
3. utilizes an equipment maintenance sheet or card that:				
a. includes all the information needed for the maintenance procedures	☐	☐	☐	
b. has provision for a record of completed maintenance procedures	☐	☐	☐	
c. is simple and easy to use	☐	☐	☐	
4. includes some form of overall schedule for all maintenance functions	☐	☐	☐	
5. identifies which maintenance operations are to be done by the teacher, students, maintenance staff, or outside firms	☐	☐	☐	
6. assigns maintenance operations:				
a. on the basis of the person's appropriate functions or expertise	☐	☐	☐	
b. using accepted school policies	☐	☐	☐	
7. provides for appropriate instruction in maintenance operations for students	☐	☐	☐	
8. is in accord with local, state, and national health and safety regulations	☐	☐	☐	
9. includes policies for emergency repairs	☐	☐	☐	
10. is organized in some logical file or notebook form	☐	☐	☐	
11. is easy for others to understand and to work from	☐	☐	☐	
12. is neat and legible	☐	☐	☐	

LEVEL OF PERFORMANCE: All items must receive FULL, or N/A responses. If any item receives a NO, or PARTIAL response, review the material in the information sheet, Laboratory Equipment Maintenance Systems, pp. 34–38, revise your plan accordingly, or check with your resource person if necessary.

NOTES

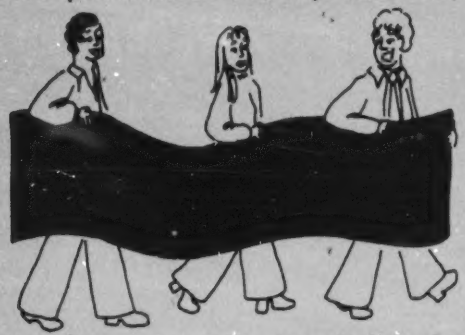
Learning Experience IV

OVERVIEW

For a discussion of the role of students in the management and maintenance of the vocational education laboratory, and recommendations on setting up student personnel systems, read the following information sheet:

STUDENT PARTICIPATION IN LABORATORY MANAGEMENT

Students should be integrally involved in the ongoing management of the vocational laboratory. Their participation can be a source of personal development to them. They can learn some of the general responsibilities of their occupation, and they can assume some of the load that otherwise you would have to attempt to carry alone. If everyone in the class shares in the management of the vocational laboratory, the duties of any one student will not be burdensome, but will be a source of positive satisfaction. By mutual cooperation, the class may well develop a feeling of group responsibility and group solidarity.



Students can participate in laboratory management in **two basic ways.** They can take major responsibility for **routine cleanup** of the laboratory at the end of the class period, and they can participate in a great variety of ways in the **day-to-day running** of the vocational facility. The extent and the degree of their participation will, however, vary greatly with the type of vocational program, the maturity of the students, and the general expectations of the school community.

You must gauge these factors fairly accurately so as to give students a valuable experience without causing resentment or frustration, or endangering the efficient running of the program. **Under no circumstances** should students be **exploited** by being required to do things that are the responsibilities of others, or that are not a legitimate part of the instructional program.

Beyond the class and laboratory assignments, there are a number of tasks that can be used to help students learn something of their varied roles and responsibilities in their chosen occupation. Workers need to know how to **care for the tools** of their trade, how to **keep their work stations orderly,** how to **work cooperatively** with others, how to **prevent waste** of supplies. In many occupations, they need to know how to do **routine maintenance** and **adjustment of equipment.** A laboratory management system that provides students with opportunities to learn and practice these skills will be of great benefit to them.

There are few teachers who would disagree with the idea that vocational laboratories should be kept as clean and orderly as the work situation allows. Cleanliness usually makes the task easier and more efficient, is a factor in laboratory safety, fosters careful and accurate work habits, and provides a pleasant environment in which to work. On the other hand, dirt and disorder can make good workmanship difficult or impossible, create hazardous conditions, and lead to student frustration and apathy.

The degree to which cleanliness is desirable (or even possible) depends very much on the occupational program, of course. It is quite obvious that laboratories for occupations like food preparation, dental hygiene, and nurses' aide require not just cleanliness but a high level of sanitation.

Other programs such as architectural drawing or automobile painting must have clean surroundings if the job is to be done to occupational standards of excellence. In metal foundry, mine safety, or horticulture it may not be appropriate to strive for a very high level of clean laboratory conditions. By working in a well-managed laboratory, students can learn the kinds of cleanliness and order that are the accepted standards in the occupation.

Vocational teachers are not in complete agreement as to the extent that students should be involved in daily cleanup and maintenance of the laboratory. Many teachers take the position that maintaining a clean and orderly work station is part of the job that the student will perform once he/she is employed. They contend that students should learn the necessary work habits while in the vocational education program. They feel that students should have **some** daily responsibility for cleanup and maintenance of the entire vocational

laboratory to help them develop the desirable traits of dependability and responsibility.

Other vocational teachers feel that students are being exploited if they are required to clean and maintain the laboratory beyond putting away tools and materials they have used at their work stations. These teachers assert that the routine cleaning of the laboratory is the job of the custodial staff, and that equipment maintenance is the responsibility of the teacher or the physical plant staff.

Perhaps each of these positions can be justified, depending on the specific vocation for which training is being done, and the situation in the school. Most certainly, periodic major cleaning such as washing walls, cleaning carpets, dusting light fixtures, or emptying dust collectors should **not** be done by students. In most instances, if students do clean equipment, work benches, and tables, their responsibility should end at the floor level.

An exception to this may be where two or more classes work in the laboratory during the day, with no custodial services available between the two. In laboratories where the normal activities produce a great deal of scrap (such as metal chips or wood shavings) it is unfair, and perhaps unsafe, for the second group to have to work in an unswept laboratory while the first class gets a clean one. In such situations, it may be necessary for students to clean the floors as well as the work stations before leaving the laboratory.

For some students, learning how to keep things clean and organized may be an important personal learning experience. Students may come from homes where disorder is the normal state, or they may have been indulged to the extent of never having had to assume any responsibility for the cleanliness of their surroundings. In both cases, you may need to actually teach the basic skills of laboratory cleaning that may seem obvious or second nature to most people.

Regardless of the extent to which students are involved in cleanup and maintenance procedures, you must plan and organize carefully to get the job done efficiently and effectively. The plan must also be presented to the student group in a way that will enlist their cooperation. Following are some guidelines that will help you to plan and implement a system of cleaning and maintaining the vocational laboratory.

Identify all the cleaning and maintenance activities necessary to maintain a desirable learning environment.—Develop a list of work areas, equipment, materials, or inspections that must be regularly and routinely covered. Such a list will vary greatly with the vocational training program. A list of some typical cleanup and maintenance duties, as shown in Sample 7, may stimulate your thinking about your own vocational program.

Beginning students will be able to do only basic and routine tasks, but as they advance in their training they should be able to sharpen tools, adjust or recalibrate instruments, provide preventive maintenance service to heavy equipment, and keep accurate records. Finally, under the teacher's supervision, they may take over much of the serious responsibility of managing the laboratory.

Consult with the custodial staff for assistance in determining which cleaning responsibilities can best be assumed by students and which by custodial staff.—You will probably want to make some preliminary decisions yourself before you attempt to get agreement from the custodians. There may be some tasks you will definitely want to reserve for yourself, and some for your students. Some vocational teachers want to make sure, for example, that custodians do not have access to certain tools or pieces of equipment that they are not trained to handle properly. If at all possible, secure agreement with the custodial staff through negotiation, without calling in the school administrator to settle differences.

Develop a class schedule for student responsibilities for cleanup.—The cleanup system adopted should be based on the laboratory instructional activities, number of students in the class, level of maturity, and the time available. Depending on needs, the system can be a very simple one, or very elaborate and worked out in detail. If every student works at a specifically assigned and limited area (as, for example, in drafting) it may be enough to have the student clean his/her own desk or work station.

In programs where a variety of activities are carried on throughout the laboratory (e.g., food preparation), it will probably be necessary to specially devise a system that distributes the cleanup tasks fairly. The assignments should be regularly rotated, so each student goes through all the tasks during a semester.

Vocational teachers have devised many ingenious systems for maintaining the cleanup schedule. These include assignment wheels that are moved ahead at regular intervals (usually each week), student name tags that are aligned with cleanup assignments, personnel charts, and other devices. One of these devices is illustrated in Figure 1.

In adult classes, it may be necessary only to explain to the group what needs to be done to keep the laboratory clean and then ask everyone to "pitch in" to help get the job done. This does not always work well, however, so you should not hesitate to set up a planned system. Adult groups, like

most people, like to know what is expected of them, and they respond favorably to systematically managed laboratories.

Orient students to the system for cleaning and maintaining the laboratory.—It is very important to the success of any cleanup system that the students understand it and agree to it. You should expect that students may have questions and concerns. Therefore, the presentation of the system should be planned in advance and carefully presented. Students need to understand how their participation will benefit themselves and others. In addition, they need to be able to see that the work is fairly and equitably distributed.

SAMPLE 7

Implement the system with the help of the students.—The cleanup and maintenance system should begin functioning on a fixed day. You should check to see that each person knows his or her particular duty. Many students will need to be shown how to clean a particular machine, where a tool is to be stored, how to arrange the materials storage rack, or even how to use the cleaning utensils.

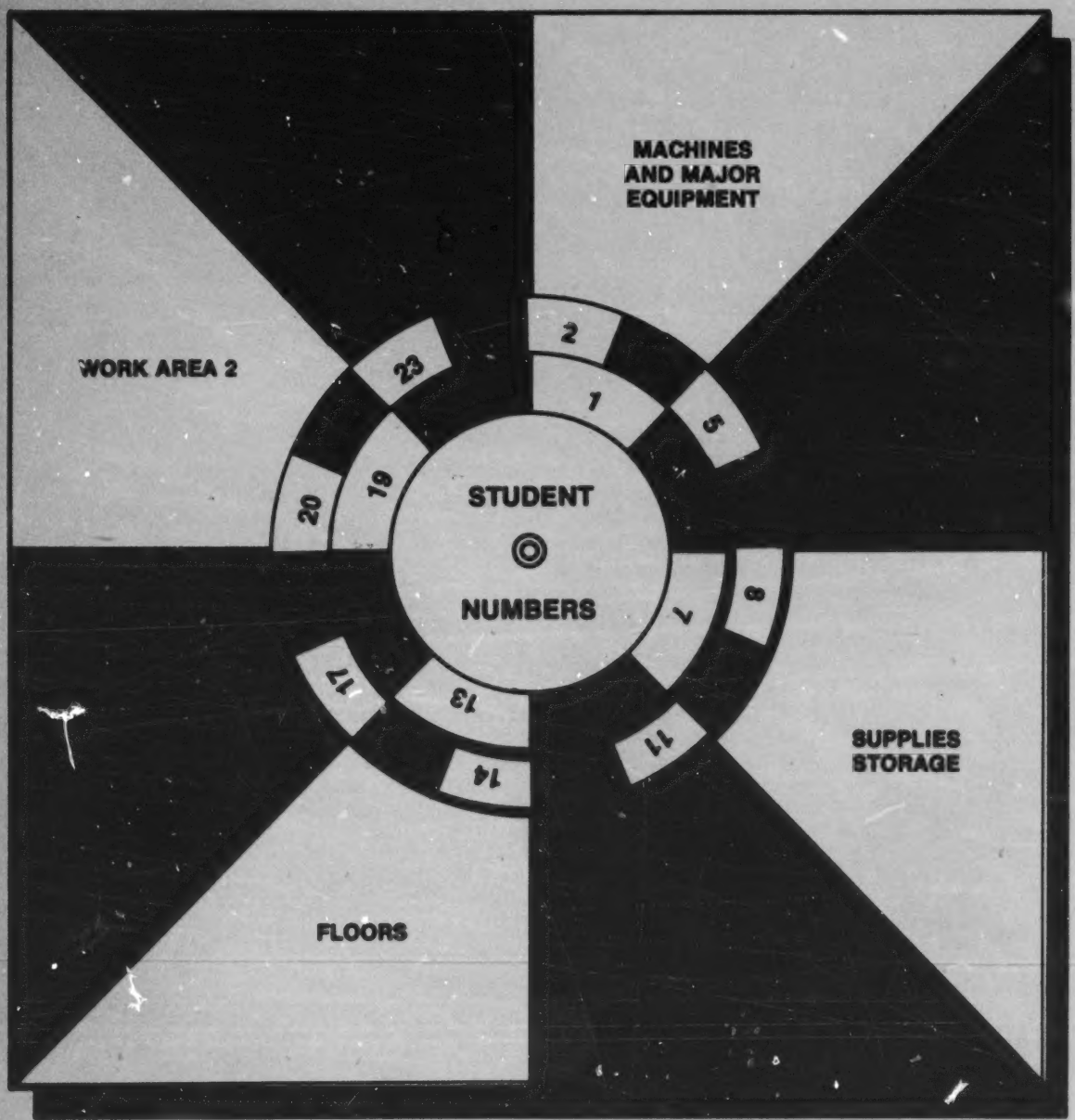
There should be relatively few snags with a well-designed system, but if difficulties do come to light, don't hesitate to modify the assignments. The most common problem is that of distributing the tasks so that they all take about the same length of time, thus permitting the group to finish together. Students often have very good (and pointed) suggestions to make as to how the system can be improved.

Provide for continuous evaluation of student performance in the cleanup and maintenance of the laboratory.—If cleanup and maintenance activities are part of the program's learning experiences (as they should be), then student performance should be regularly evaluated. In most cases, a simple "satisfactory," "unsatisfactory" rating is all that is required, with daily or weekly teacher evaluations.

In addition to cleanup and maintenance, there are often a number of other ways in which students can profitably participate in the ongoing functioning of the vocational laboratory. Individual students can keep class attendance records, distribute laboratory supplies, inspect for safe working conditions, greet and escort visitors around the laboratory, and take over responsibility for the class if you are away from the laboratory.

FIGURE 1

ASSIGNMENT WHEEL



In some programs, it may be desirable to set up a formal class organization with officers such as foreman, assistant foreman, secretary, and safety inspector. For these jobs, you can choose students

who are the most able members of the class, or students who most need the experience. Perhaps an even better way is to ask the class to nominate and elect class members to fill the positions. It is wise to change class officers at least every semester so that many students have an opportunity to get involved.

Students can, and usually should, participate in many aspects of laboratory management, but you are ultimately responsible for the total operation of the program. You are responsible for laboratory instruction, handling of supplies, maintenance of tools and equipment, and the safety of students. Therefore, as students work in management activities, it is essential for you to oversee the activities and supervise the students.

For example, you can use students to assist in keeping attendance books and posting grades. However, it is important that you verify the accuracy of these records. In some areas, the class record book is a legal document that can be used in court to determine the whereabouts or activities of a student at a particular time. In time-based programs, the attendance record is often the basis for issuing a certificate showing that the student has completed the training program.

You may wish to arrange through your resource person to visit a vocational education laboratory in your occupational specialty to observe a student personnel system in operation. During your visit, you may wish to interview students, as well as the teacher, to obtain their views on the characteristics of a good personnel system.

For a vocational laboratory in your occupational specialty develop a complete plan for a laboratory cleanup system to be operated by students. Confine your plan to a cleanup system rather than a student personnel system which includes other managerial functions. If you are a preservice teacher, you may use one of your college laboratory classes, or a secondary class with which you are working, as the basis for your plan. If you are an inservice teacher, you may use your own laboratory class as a basis for your plan.

After you have developed your plan, use the Student Personnel System Checklist, p. 49, to evaluate your work.

STUDENT PERSONNEL SYSTEM CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following performance components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

Name _____

Date _____

Resource Person _____

LEVEL OF PERFORMANCE

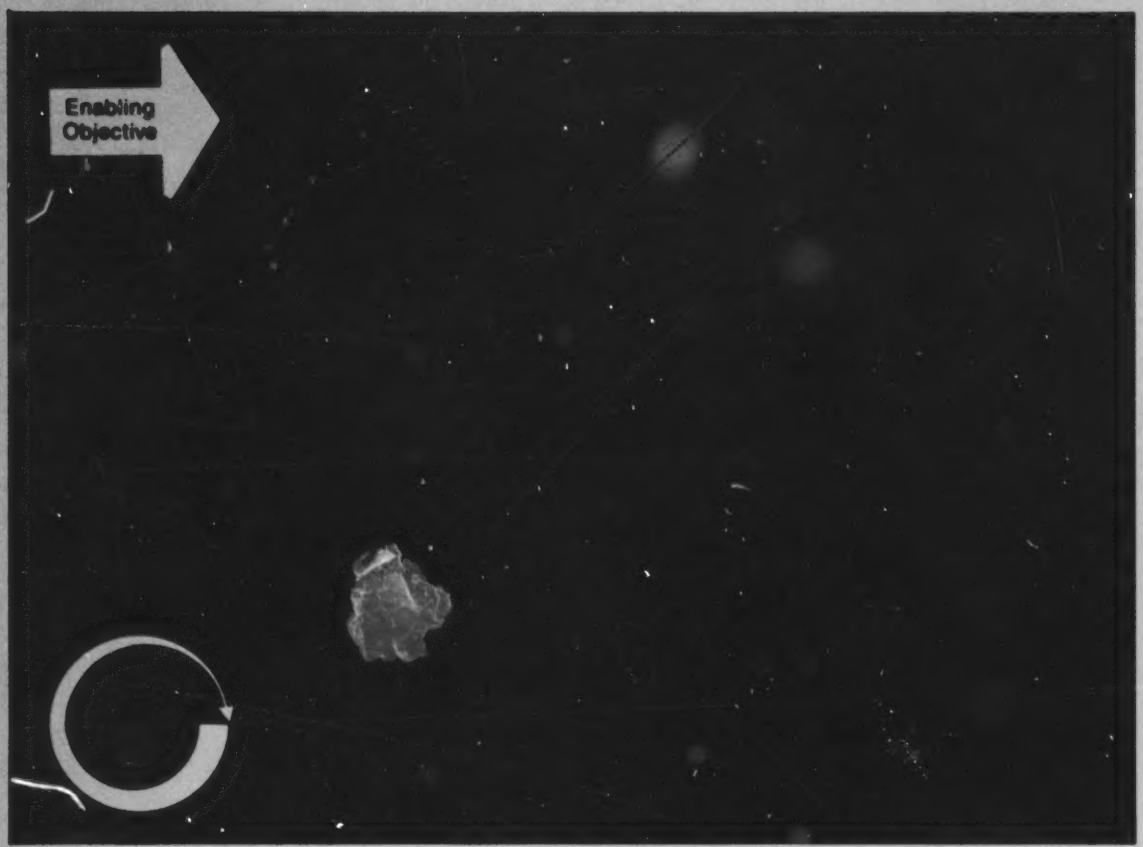
	N/A	No	Partial	Full
The laboratory cleanup plan:				
1. correctly identifies all the cleanup activities necessary to maintain the laboratory environment	☐	☐	☐	
2. assigns cleanup tasks for students consistent with occupational expectations	☐	☐	☐	
3. divides the tasks equitably so all students are involved	☐	☐	☐	
4. includes a rotation system so all students have a variety of experiences	☐	☐	☐	
5. includes a student performance evaluation system that is fair and easy to maintain	☐	☐	☐	
6. includes procedures for orienting students to the cleanup plan	☐	☐	☐	
7. provides for teaching individual students necessary cleanup skills	☐	☐	☐	
8. assigns leadership positions to students who can most benefit from the experience	☐	☐	☐	
9. sets standards of laboratory orderliness and cleanliness consistent with the needs of the occupation	☐	☐	☐	
10. provides for change and improvement in the plan on the basis of input by students	☐	☐	☐	

LEVEL OF PERFORMANCE: All items must receive FULL, or N/A responses. If any item receives a NO, or PARTIAL response, review the material in the information sheet, Student Participation in Laboratory Management, pp. 44–48, revise your plan accordingly, or check with your resource person if necessary.

NOTES

Learning Experience V

OVERVIEW



Arrange through your resource person to visit a vocational education laboratory in your occupational specialty and to observe the laboratory in operation.

Obtain the approval of the teacher to collect information about the operation of the laboratory, and permission to talk to students about laboratory procedures. Observe the laboratory in operation for at least one full class session, from beginning to end.

If there is no laboratory available to you that is directly concerned with your vocational interests, visit a laboratory that is as closely related as possible.

After you have left the laboratory, evaluate the effectiveness of the system used for laboratory management using the Laboratory Observation Checklist, pp. 53–54, as a guide. Unless the teacher invites you to do otherwise, **do not** make checks or write notes until you have left the laboratory.

Prepare a brief summary report of the strengths in the way the laboratory was managed, and any deficiencies you identified. Confine your observations to the **management** of the laboratory, rather than to the physical facility or its arrangement.

Prepare a series of recommendations for improving the laboratory management system.

LABORATORY OBSERVATION CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a component was not applicable to the particular laboratory you are visiting, place an X in the N/A box.

Name _____

Date _____

Resource Person _____

LEVEL OF PERFORMANCE

	N/A	No	Partial	Full
General Management				
1. Management procedures are in apparent agreement with the goals and objectives of the program	☐	☐	☐	
2. Tools are stored so as to be accessible and convenient to students	☐	☐	☐	
3. Students have all necessary supplies for laboratory activities	☐	☐	☐	
4. Distribution of supplies is effective in avoiding waste and loss	☐	☐	☐	
5. Work in the laboratory is organized to make maximum use of available work stations	☐	☐	☐	
6. A chart is maintained to record student progress in the laboratory	☐	☐	☐	
Environmental Control				
7. Ventilation and temperature in the laboratory is at the appropriate level	☐	☐	☐	
8. Lighting is at the proper level for the activities taking place	☐	☐	☐	
9. Noise in the laboratory is at a minimum level	☐	☐	☐	
10. The laboratory is clean and orderly as appropriate for the activities	☐	☐	☐	
11. The laboratory is appropriately attractive for the activities taking place	☐	☐	☐	
Maintenance of Equipment				
12. Equipment is maintained in good operating condition	☐	☐	☐	
13. Students are involved in laboratory maintenance as appropriate for the occupation	☐	☐	☐	
14. An equipment maintenance record-keeping system is maintained	☐	☐	☐	
15. Routine maintenance for equipment is provided on a regular basis	☐	☐	☐	
Equipment Inventory				
16. A complete inventory control system for tools and equipment is maintained	☐	☐	☐	

	N/A	No	Partial	Full
17. The system provides for adding new equipment and deleting items no longer in the laboratory	☐	☐	☐	
18. A special inventory system controls items that are especially expensive, delicate, or hazardous	☐	☐	☐	
Student Participation				
19. Students have cleaning and maintenance responsibilities appropriate to occupational expectations	☐	☐	☐	
20. An equitable rotation system is maintained for assigning student cleanup duties	☐	☐	☐	
21. Students have been given instruction in their maintenance responsibilities	☐	☐	☐	
22. Student performance in cleaning and maintaining the laboratory is individually evaluated	☐	☐	☐	
Use of Laboratory by Others				
23. A schedule indicates the time and extent of use of the laboratory facility by others	☐	☐	☐	
24. Separate storage is provided for projects and materials of each student group using the laboratory	☐	☐	☐	

After you have evaluated the vocational laboratory management system and have developed recommendations for its improvement, arrange to have your resource person review and evaluate your work. Give him/her the Laboratory Management Planning Checklist, pp. 55–56, to use in evaluating your work.

LABORATORY MANAGEMENT PLANNING CHECKLIST

Directions: Place an X in the NO, PARTIAL, or FULL box to indicate that each of the following performance components was not accomplished, partially accomplished, or fully accomplished. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

Name _____

Date _____

Resource Person _____

LEVEL OF PERFORMANCE

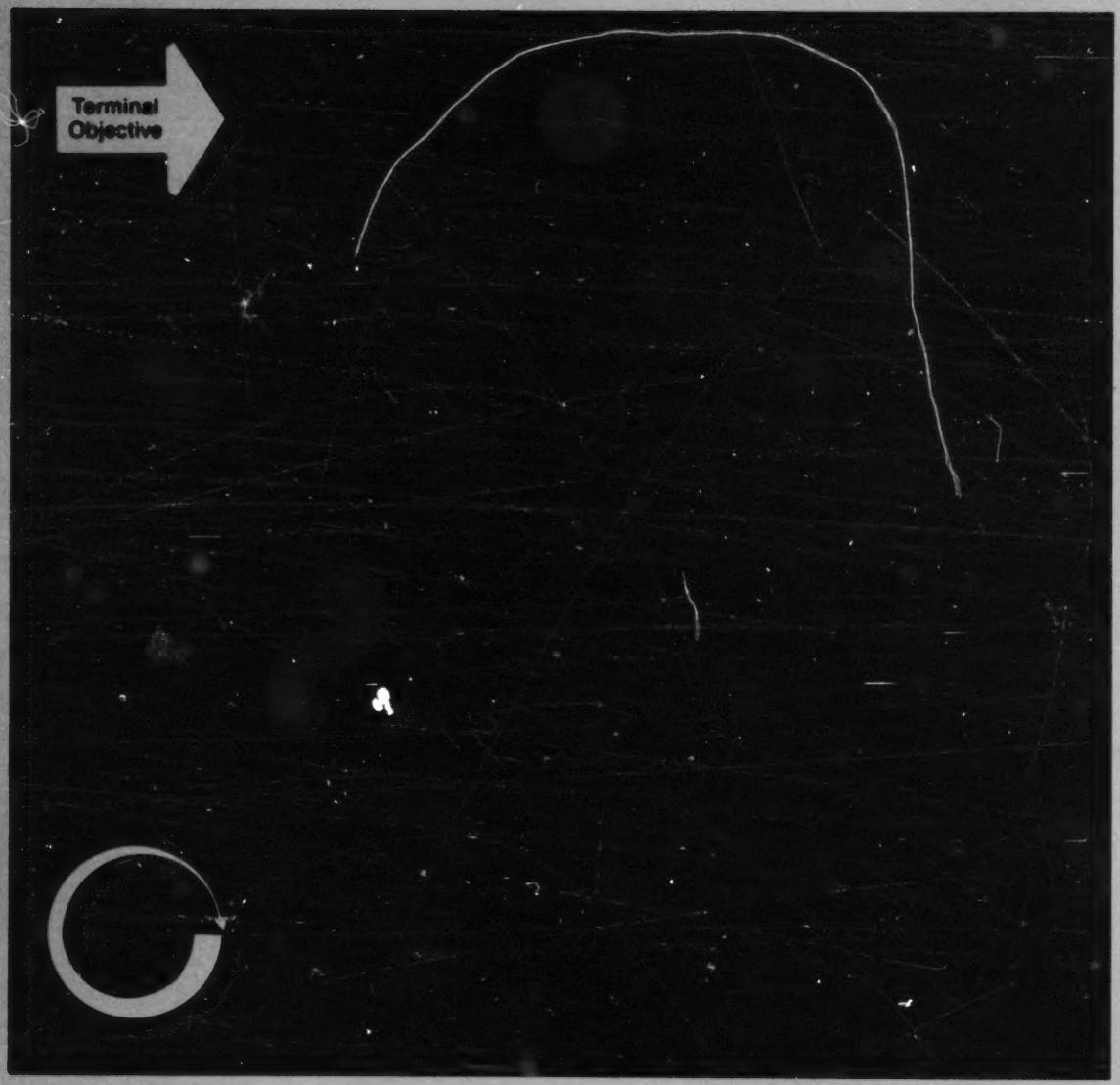
	N/A	No	Partial	Full
In evaluating the laboratory management, the teacher:				
1. made an evaluation of all the appropriate activities in the laboratory	☐	☐	☐	
2. applied general principles of laboratory management and maintenance to the specific situation	☐	☐	☐	
3. accurately identified the important characteristics and major deficiencies of the management of the laboratory	☐	☐	☐	
4. dealt only with laboratory management and maintenance, rather than with the physical facility	☐	☐	☐	
The teacher's recommendations and plans for improvement of the laboratory management system:				
5. corrected all the major deficiencies identified	☐	☐	☐	
6. were feasible and practical in application	☐	☐	☐	
7. were realistic in terms of actual school situations	☐	☐	☐	
8. were in keeping with the goals and objectives of the vocational education program	☐	☐	☐	
9. applied accepted principles of vocational laboratory management	☐	☐	☐	
10. were presented in a well-organized, clear, and readable form	☐	☐	☐	

	N/A	No	Partial	Full
11. made adequate provision for:				
a. maintaining a clean, orderly, and attractive laboratory	☐	☐	☐	
b. maintaining comfortable and healthful environmental conditions	☐	☐	☐	
c. providing and distributing supplies efficiently	☐	☐	☐	
d. maintaining the equipment in good operating condition	☐	☐	☐	
e. maintaining an effective inventory control system	☐	☐	☐	
f. involving students appropriately in maintaining the laboratory	☐	☐	☐	
g. scheduling the use of the laboratory to utilize it to the maximum extent	☐	☐	☐	

LEVEL OF PERFORMANCE: All items must receive FULL, or N/A responses. If any item receives a NO, or PARTIAL response, the teacher and resource person should meet to determine what additional activities the teacher needs to complete in order to reach competency in the weak area(s).

Learning Experience VI

FINAL EXPERIENCE



*For a definition of "actual school situation," see the inside back cover.

NOTES

TEACHER PERFORMANCE ASSESSMENT FORM

Manage the Vocational Laboratory (E–9)

Name _____

Date _____

Resource Person _____

Directions: Indicate the level of the teacher's accomplishment by placing an X in the appropriate box under the LEVEL OF PERFORMANCE heading. If, because of special circumstances, a performance component was not applicable, or impossible to execute, place an X in the N/A box.

	LEVEL OF PERFORMANCE					
	N/A	None	Poor	Fair	Good	Excellent
In the general management of the laboratory, the teacher:						
1. utilized management procedures consistent with the goals and objectives of the program	☐	☐	☐	☐		
2. organized tool storage so tools are accessible and convenient to students	☐	☐	☐	☐		
3. provided all appropriate supplies necessary for laboratory activities	☐	☐	☐	☐		
4. controlled the distribution of supplies to students to avoid waste and loss	☐	☐	☐	☐		
5. organized the use of available work stations so all students were productive	☐	☐	☐	☐		
6. rotated students among work stations so all could obtain necessary laboratory experiences	☐	☐	☐	☐		
7. maintained a student progress chart to record laboratory activities and achievement	☐	☐	☐	☐		
8. provided "open lab" time for students in addition to scheduled laboratory instruction	☐	☐	☐	☐		
In controlling the laboratory environment, the teacher:						
9. maintained the ventilation and temperature of the air at the appropriate level for the activities taking place	☐	☐	☐	☐		
10. adjusted the natural and artificial lighting in the room to maintain the proper level for the activities taking place	☐	☐	☐	☐		
11. controlled noise produced within the laboratory to keep it at a suitable minimum	☐	☐	☐	☐		
12. worked with the custodial staff to provide for any special environmental conditions required by the laboratory	☐	☐	☐	☐		
In maintaining the laboratory equipment, the teacher:						
13. inspected all laboratory tools and equipment on a regular basis	☐	☐	☐	☐		

	N/A	None	Poor	Fair	Good	Excellent
14. provided proper routine preventive maintenance on a regular basis	☐	☐	☐	☐		
15. involved students in laboratory equipment maintenance as appropriate to their occupational responsibilities	☐	☐	☐	☐		
16. acted to return out-of-order equipment to service quickly	☐	☐	☐	☐		
17. obtained major service and repairs when required	☐	☐	☐	☐		
18. maintained an accurate and current equipment maintenance record-keeping system	☐	☐	☐	☐		
In maintaining a laboratory inventory control system, the teacher:						
19. utilized an inventory plan appropriate to the specific laboratory and school situation	☐	☐	☐	☐		
20. maintained an accurate and current inventory record	☐	☐	☐	☐		
21. took a complete inventory of tools and equipment	☐	☐	☐	☐		
22. maintained special inventory control systems to handle delicate, expensive, or hazardous items	☐	☐	☐	☐		
In organizing and managing the student personnel system, the teacher:						
23. gave students cleaning and maintenance responsibilities consistent with occupational expectations	☐	☐	☐	☐		
24. worked out an equitable rotation system for assigning student cleanup duties	☐	☐	☐	☐		
25. oriented students to the system of cleaning and maintaining the laboratory	☐	☐	☐	☐		
26. instructed each student about his/her responsibilities in maintaining work areas and storage space	☐	☐	☐	☐		
27. utilized an objective and fair evaluation system for student performance in cleanup and maintenance activities	☐	☐	☐	☐		
In establishing a policy on laboratory use by others, the teacher:						
28. worked cooperatively with the administration and with others involved to establish policies fair to all groups	☐	☐	☐	☐		
29. established policies to protect the vocational laboratory facilities and equipment	☐	☐	☐	☐		

LEVEL OF PERFORMANCE: All items must receive N/A, GOOD, or EXCELLENT responses. If any item receives a NONE, POOR, or FAIR response, the teacher and resource person should meet to determine what additional activities the teacher needs to complete in order to reach competency in the weak area(s).

ABOUT USING THE CENTER'S PBTE MODULES

Organization

Each module is designed to help you gain competency in a particular skill area considered important to teaching success. A module is made up of a series of learning experiences, some providing background information, some providing practice experiences, and others combining these two functions. Completing these experiences should **enable** you to achieve the **terminal** objective in the final learning experience. The final experience in each module always requires you to demonstrate the skill in an actual school situation when you are an intern, a student teacher, or an inservice teacher.

Procedures

Modules are designed to allow you to individualize your teacher education program. You need to take only those modules covering skills which you do not already possess. Similarly, you need not complete any learning experience within a module if you already have the skill needed to complete it. Therefore, before taking any module, you should carefully review (1) the Introduction, (2) the Objectives listed on p. 4, (3) the Overviews preceding each learning experience, and (4) the Final Experience. After comparing your present needs and competencies with the information you have read in these sections, you should be ready to make one of the following decisions:

- that you do not have the competencies indicated, and should complete the entire module
- that you are competent in one or more of the enabling objectives leading to the final learning experience, and thus can omit that (those) learning experience(s)
- that you are already competent in this area, and ready to complete the final learning experience in order to "test out"
- that the module is inappropriate to your needs at this time

When you are ready to take the final learning experience and have access to an actual school situation, make the necessary arrangements with your resource person. If you do not complete the final experience successfully, meet with your resource person and arrange (1) to repeat the experience, or (2) complete (or review) previous sections of the module or other related activities suggested by your resource person before attempting to repeat the final experience.

Options for recycling are also available in each of the learning experiences preceding the final experience. Any time you do not meet the minimum level of performance required to meet an objective, you and your resource person may meet to select activities to help you reach competency. This could involve (1) completing parts of the module previously skipped; (2) repeating activities; (3) reading supplementary resources or completing additional activities suggested by the resource person; (4) designing your own learning experience; or (5) completing some other activity suggested by you or your resource person.

Terminology

Actual School Situation . . . refers to a situation in which you are actually working with, and responsible for, secondary or post-secondary vocational students in a real school. An intern, a student teacher, or an inservice teacher would be functioning in an actual school situation. If you do **not** have access to an actual school situation when you are taking the module, you can complete the module **up to** the final learning experience. You would then do the final learning experience later; i.e., when you have access to an actual school situation.

Alternate Activity or Feedback . . . refers to an item or feedback device which may **substitute** for required items which, due to special circumstances, you are unable to complete.

Occupational Specialty . . . refers to a specific area of preparation within a vocational service area (e.g., the service area Trade and Industrial Education includes occupational specialties such as automobile mechanics, welding, and electricity).

Optional Activity or Feedback . . . refers to an item which is not required, but which is designed to **supplement** and enrich the required items in a learning experience.

Resource Person . . . refers to the person in charge of your educational program; the professor, instructor, administrator, supervisor, or cooperating/supervising/classroom teacher who is guiding you in taking this module.

Student . . . refers to the person who is enrolled and receiving instruction in a secondary or post-secondary educational institution.

Vocational Service Area . . . refers to a major vocational field: agricultural education, business and office education, distributive education, health occupations education, home economics education, industrial arts education, technical education, or trade and industrial education.

You or the Teacher . . . refers to the person who is taking the module.

Levels of Performance for Final Assessment

N/A . . . The criterion was not met because it was **not applicable** to the situation.
None . . . **No attempt** was made to meet the criterion, although it was relevant.
Poor . . . The teacher is unable to perform this skill or has only **very limited ability** to perform it.
Fair . . . The teacher is unable to perform this skill in an acceptable manner, but has **some ability** to perform it.
Good . . . The teacher is able to perform this skill in an **effective** manner.
Excellent . . . The teacher is able to perform this skill in a **very effective** manner.

Titles of The Center's Performance-Based Teacher Education Modules

Category A: Program Planning, Development, and Evaluation

A-1 Prepare for a Community Survey
A-2 Conduct a Community Survey
A-3 Report the Findings of a Community Survey
A-4 Organize an Occupational Advisory Committee
A-5 Maintain an Occupational Advisory Committee
A-6 Develop Program Goals and Objectives
A-7 Conduct an Occupational Analysis
A-8 Develop a Course of Study
A-9 Develop Long-Range Program Plans
A-10 Conduct a Student Follow-Up Study
A-11 Evaluate Your Vocational Program

Category B: Instructional Planning

B-1 Determine Needs and Interests of Students
B-2 Develop Student Performance Objectives
B-3 Develop a Unit of Instruction
B-4 Develop a Lesson Plan
B-5 Select Student Instructional Materials
B-6 Prepare Teacher-Made Instructional Materials

Category C: Instructional Execution

C-1 Direct Field Trips
C-2 Conduct Group Discussions, Panel Discussions, and Symposiums
C-3 Employ Brainstorming, Buzz Group, and Question Box Techniques
C-4 Direct Students in Instructing Other Students
C-5 Employ Simulation Techniques
C-6 Guide Student Study
C-7 Direct Student Laboratory Experience
C-8 Direct Students in Applying Problem-Solving Techniques
C-9 Employ the Project Method
C-10 Introduce a Lesson
C-11 Summarize a Lesson
C-12 Employ Oral Questioning Techniques
C-13 Employ Reinforcement Techniques
C-14 Provide Instruction for Slower and More Capable Learners
C-15 Present an Illustrated Talk
C-16 Demonstrate a Manipulative Skill
C-17 Demonstrate a Concept or Principle
C-18 Individualize Instruction
C-19 Employ the Team Teaching Approach
C-20 Use Subject Matter Experts to Present Information
C-21 Prepare Bulletin Boards and Exhibits
C-22 Present Information with Models, Real Objects, and Flannel Boards
C-23 Present Information with Overhead and Opaque Materials
C-24 Present Information with Filmstrips and Slides
C-25 Present Information with Films
C-26 Present Information with Audio Recordings
C-27 Present Information with Televised and Videotaped Materials
C-28 Employ Programmed Instruction
C-29 Present Information with the Chalkboard and Flip Chart

Category D: Instructional Evaluation

D-1 Establish Student Performance Criteria
D-2 Assess Student Performance: Knowledge
D-3 Assess Student Performance: Attitudes
D-4 Assess Student Performance: Skills
D-5 Determine Student Grades
D-6 Evaluate Your Instructional Effectiveness

Category E: Instructional Management

E-1 Project Instructional Resource Needs
E-2 Manage Your Budgeting and Reporting Responsibilities
E-3 Arrange for Improvement of Your Vocational Facilities
E-4 Maintain a Filing System
E-5 Provide for Student Safety
E-6 Provide for the First Aid Needs of Students
E-7 Assist Students in Developing Self-Discipline
E-8 Organize the Vocational Laboratory
E-9 Manage the Vocational Laboratory

Category F: Guidance

F-1 Gather Student Data Using Formal Data-Collection Techniques
F-2 Gather Student Data Through Personal Contacts
F-3 Use Conferences to Help Meet Student Needs
F-4 Provide Information on Educational and Career Opportunities
F-5 Assist Students in Applying for Employment or Further Education

Category G: School-Community Relations

G-1 Develop a School-Community Relations Plan for Your Vocational Program
G-2 Give Presentations to Promote Your Vocational Program
G-3 Develop Brochures to Promote Your Vocational Program
G-4 Prepare Displays to Promote Your Vocational Program
G-5 Prepare News Releases and Articles Concerning Your Vocational Program
G-6 Arrange for Television and Radio Presentations Concerning Your Vocational Program
G-7 Conduct an Open House
G-8 Work with Members of the Community
G-9 Work with State and Local Educators
G-10 Obtain Feedback about Your Vocational Program

Category H: Student Vocational Organization

H-1 Develop a Personal Philosophy Concerning Student Vocational Organizations
H-2 Establish a Student Vocational Organization
H-3 Prepare Student Vocational Organization Members for Leadership Roles
H-4 Assist Student Vocational Organization Members in Developing and Financing a Yearly Program of Activities
H-5 Supervise Activities of the Student Vocational Organization
H-6 Guide Participation in Student Vocational Organization Contests

Category I: Professional Role and Development

I-1 Keep Up-to-Date Professionally
I-2 Serve Your Teaching Profession
I-3 Develop an Active Personal Philosophy of Education
I-4 Serve the School and Community
I-5 Obtain a Suitable Teaching Position
I-6 Provide Laboratory Experiences for Prospective Teachers
I-7 Plan the Student Teaching Experience
I-8 Supervise Student Teachers

Category J: Coordination of Cooperative Education

J-1 Establish Guidelines for Your Cooperative Vocational Program
J-2 Manage the Attendance, Transfers, and Terminations of Co-Op Students
J-3 Enroll Students in Your Co-Op Program
J-4 Secure Training Stations for Your Co-Op Program
J-5 Place Co-Op Students on the Job
J-6 Develop the Training Ability of On-the-Job Instructors
J-7 Coordinate On-the-Job Instruction
J-8 Evaluate Co-Op Students' On-the-Job Performance
J-9 Prepare for Students' Related Instruction
J-10 Supervise an Employer-Employee Appreciation Event

RELATED PUBLICATIONS

Student Guide to Using Performance-Based Teacher Education Materials
Resource Person Guide to Using Performance-Based Teacher Education Materials
Guide to the Implementation of Performance-Based Teacher Education

For information regarding availability and prices of these materials contact—

AAVIM
American Association for Vocational Instructional Materials
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